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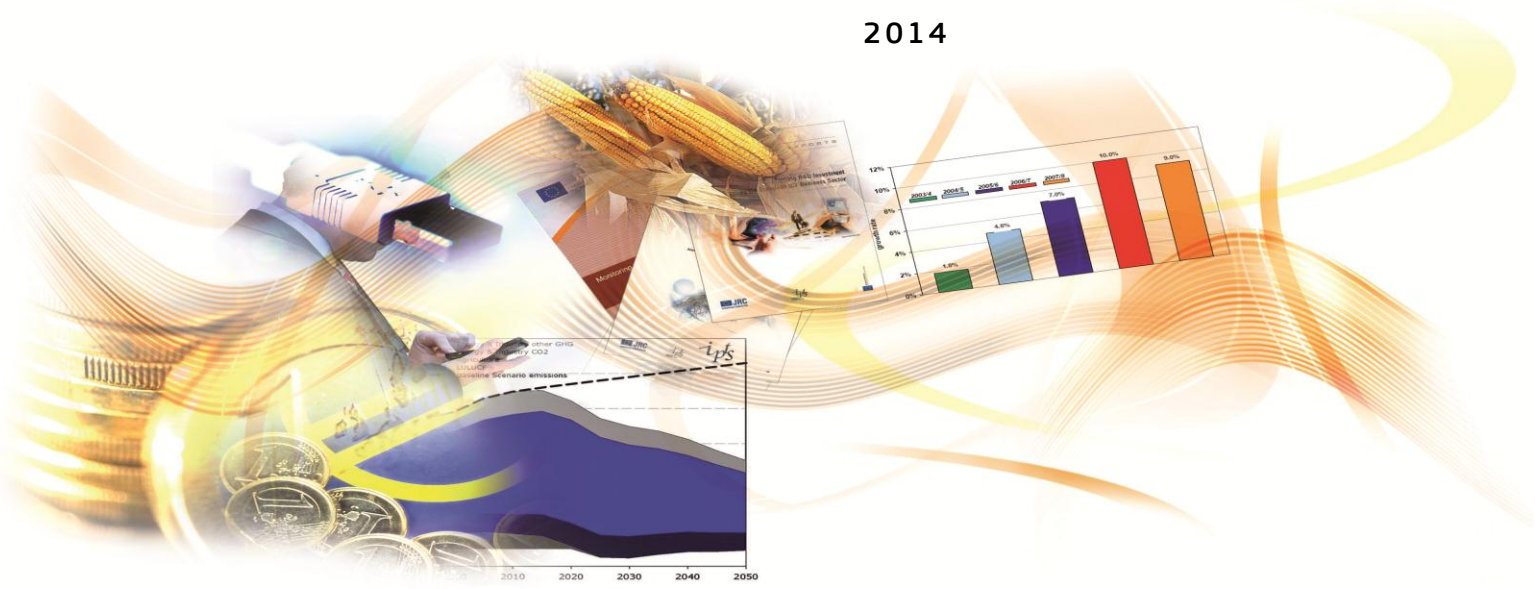

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Abstract

The Analytical Country Reports analyse and assess in a structured manner the evolution of the national policy research and innovation in the perspective of the wider EU strategy and goals, with a particular focus on the performance of the national research and innovation (R&I) system, their broader policy mix and governance. The 2013 edition of the Country Reports highlight national policy and system developments occurring since late 2012 and assess, through dedicated sections:

- national progress in addressing Research and Innovation system challenges;
- national progress in addressing the 5 ERA priorities;
- the progress at Member State level towards achieving the Innovation Union;
- the status and relevant features of Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3);
- as far relevant, country Specific Research and Innovation (R&I) Recommendations.

Detailed annexes in tabular form provide access to country information in a concise and synthetic manner.
The reports were originally produced in December 2013, focusing on policy developments occurring over the preceding twelve months.

ACKNOWLEDGMENTS AND FURTHER INFORMATION

This analytical country report is one of a series of annual ERAWATCH reports produced for EU Member States and Countries Associated to the Seventh Framework Programme for Research of the European Union (FP7). ERAWATCH is a joint initiative of the European Commission's Directorate General for Research and Innovation and Joint Research Centre.

The Country Report 2013 builds on and updates the 2012 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges**,** highlighting the latest developments, their dynamics and impact in the overall national context.

The first draft of this report was produced in December 2013 and was focused on developments taking place in the previous twelve months. In particular, it has benefitted from the comments and suggestions of Patrice dos Santos from JRC-IPTS. The contributions and comments from DG-RTD and The contributions and comments from Dr Emira Bečić, Bojan Grlaš and Ivan Lakoš, Ministry of Science, Education and Sports, Alessia Pozzi, Ivana Crnić - Duplančić and Ivana Čuljak, Business Innovation Croatian Agency, BICRO and Antonija Gladović, Agency for Mobility and EU Programmes are also gratefully acknowledged.

The report is currently only published in electronic format and is available on the ERAWATCH website. Comments on this report are welcome and should be addressed to jrc-ipts-erawatch-helpdesk@ec.europa.eu.

EXECUTIVE SUMMARY

The Croatian research and innovation system has evolved over the last decade into a complex system of various institutions and measures directed to build innovation-driven growth. The Ministry of Science, Education and Sports (MSES) is the pillar institution of the entire research and education policy and innovation policy concerning conditions for economic growth based on knowledge and exploitation of research results. The Ministry of Entrepreneurship and Crafts and the Ministry of Economy complement the national innovation policy related to innovation-based entrepreneurship and business infrastructure. The role of the Ministry of Regional Development and European Funds has increased upon the Croatian accession to EU.

The National Science Council and the National Council for Higher Education were merged into the National Council for Science, Education and Technology Development, with the aim to harmonize the overall development of the R&D and innovation system.

The main funding bodies, in addition to the MSES, are the Croatian Science Foundation (CSF) (fostering science excellence) and the Business Innovation Agency of Croatia (BICRO) (supporting various innovation policy programmes like RAZUM, TEHCRO, IRCRO, PoC, etc.). The remaining stakeholders in research and innovation system which do not provide funding are: the Agency for Science and Higher Education (ASHE) with the task of setting up a national network for quality assurance, and the Croatian Agency for Mobility and EU Programs (AMPEU) in order to organise programmes for lifelong learning and the EU mobility programmes.

The system changes have been initiated by the new Act on Science and Higher Education adopted by the Croatian Parliament on 15 July 2013 which brought many changes to increase the efficiency of the R&D system, which include:

- New model of financing scientific activities from the State budget via MSES based on the Multi-annual institutional funding for research programmes.
- The allocation of the competition based research project grants has been transferred from MSES to the CSF, and assumes a rigid evaluation process that should end up with a small number of high quality research projects (around 20% of proposals).
- Launch of the scientific centres of excellence (SCE) for the first time in Croatia.
- CSF has undergone significant organisational and programme changes. Since 1 October 2013 when the new model of research funding came into force, all the previous programmes of CSF were (currently) terminated.
- A takeover of the Unity through Knowledge Fund (UKF) by CSF is planned to be implemented during 2014.

National priorities of the research and innovation policy have remained the same in the absence of new relevant policies. Main priorities have been set by the Science and Technology Policy 2006 – 2010, and include the following goals: (1) Increase investment in research and development towards the "3% target"; (2) Reform the Croatian science system in order to build the synergy of the research potentials and implement functional and financial integration of the universities; (3) Strengthen cooperation among science, government and industry when creating new knowledge and goods in order to capitalise scientific research; (4) Increase participation of Croatian scientists in EU framework programmes. These goals are expected to be adjusted to current situation and needs of Croatian economy, with the introduction of National Strategy for the Croatian innovation development 2013-2020, Smart Specialisation Strategy and National Industrial Strategy that are currently being developed.

By the Innovation Union Scoreboard 2013 (IUS, 2013) Croatia is a moderate innovator with a below average performance. Croatia's main strengths are in Human resources and Economic effects, while main weaknesses lie in Open, excellent and attractive research systems and Intellectual assets. R&D and innovations are highly under-funded in Croatia, and their budgets have been decreasing since 2009, reaching only 0.75% of GDP in 2012. Government funds the majority of research activities performed in the country (45.5% of GERD in 2012) and institutional funding is still a main channel for allocation of budget resources to R&D. However, the share of project-based funding has been slowly increasing since 2012 and is expected to increase further over the next years. Research and development activities in business sector are mostly funded by companies themselves (65.6%), with an increasing share of financial resources coming from abroad, which doubled in the period of four years. Access to finance for small innovative companies and start-ups remained as one of the strongest obstacles for innovation development in Croatia. Venture capital funding is highly limited and underdeveloped.

Cooperation between science and industry is currently at very low levels, and has become recognised as one of the main development priorities in Croatia. Despite the increasing awareness of importance and benefits of innovation, the share of SMEs introducing innovations has been gradually declining over the last years.

Main structural challenges of the R&D and innovation system include:

- **The R&D policy is outdated and lacks coherent and integrated policy framework**. Despite the Science and Technology Policy 2006 – 2010 long expired, no new policies setting R&D and innovation measures have been adopted so far, although several are in the development process. There is a significant lack of communication and coordination between relevant ministries and public institutions.
- **Business environment is not conducive to innovation.** Main features of business environment in Croatia include inefficient state administration (sometimes prone to political voluntarism), financial system dominated by banks (with relatively shallow and illiquid capital market), high costs of utilities and local services, widespread illiquidity and weak linkages between education sector and the labour market.
- **Weak interest of private companies for research and development**, which is emphasised when one considers the volume and investment of private businesses R&D is low (around €30 p/c, while EU invests in average almost 10 times more, around €318.3 p/c).
- **Sluggish reforms of research and higher education system.** Despite several new initiatives and positive changes in relevant legislation, some of the main structural gaps (such as mismatch of curricula with labour market needs, fragmentation of universities etc.) have not been tackled with during the design and implementation of reforms).
- **Weak regional research and innovation system.** Croatia suffers from considerable and long-term regional disparities, which calls for strengthening the active regional research and innovation policy which is currently almost non-existent.

Assessment of the national progress towards IU Commitments identified that in most of the areas at least some improvements have been made. However, in some of the areas considered, the overall situation and progress have been evaluated as unsatisfactory, namely Priority Research Infrastructures, Venture Capital Funds, Knowledge Transfer, European Social Innovation pilot, Public Sector Innovation and European Innovation Partnerships, as well as Global research Infrastructures. The goals seem to be achieved only in the area of Open Access, mainly because

Croatia nurtures open access since 1990s and the Government makes all research data funded by public resources freely available to research community.
Analysis indicated that additional efforts should be invested towards delivery of ERA, primarily into introduction of the core principles of international peer review, design and implementation of evaluation and monitoring systems, increasing the mobility of researchers and ensuring that public research contributes to Open Innovation and foster knowledge transfer between public and private sectors through national knowledge transfer strategies.

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1 BASIC CHARACTERISATION OF THE RESEARCH AND INNOVATION SYSTEM

The Croatian economy is the most developed in Southeast Europe, reaching €10,427 of GDP per capita in 2012 (€ 43.929 billion) or around 61% of GDP of the EU-27 average. It is characterised as an upper-middle-income country. On July 1, 2013 Croatia has become the 28th member of the European Union.

The period of high economic growth from 2002 to 2008 with an average annual rate of GDP increase of 5%, was followed by five years of economic recession that brought economic downturn and cumulative decrease of GDP by 11.8% (CEOQ, 2012).The deep economic downturn coupled with cost-cutting policy and strong financial discipline takes its toll not only on spending and employment but has a negative feedback of R&D financing and future prospects.

According to the first results of Census in 2011 the Croatian population is 4.27 million inhabitants or 150,000 less than in 2001. It accounts for around 0.9% of the population of the EU-27.

The governance of R&D system in Croatia is highly centralised under the authority of the Ministry of Science, Education and Sports (MSES). It is dominated by public funding primarily based on annual budget cycles proposed by the National Science Council , the highest advisory body for the scientific research system. The Agency for Science and Higher Education (ASHE) is responsible for setting up a national network for quality assurance
The Croatian Science Foundation (CSF) is the principal funding body for scientific research since1 July 2013 when the allocation of competitive research grants was transferred from MSEs to the Foundation. MSES introduced a new type of research funding - the Multi-annual research programmes at the level of research institutes and universities, the amount of which depends on the institutional performance indicators. It makes a novelty in research policy directed towards greater financial accountability and responsibility of research institutions. The MSES will also finance the Scientific Centres of Excellence which will be established in Croatia for the first time during 2014. The Business Innovation Agency of the Republic of Croatia – (BICRO) is a pillar institution of the innovation system. The Unity through Knowledge Fund (UKF) funds a small number of high competitive projects aimed at establishing cooperation between the Croatian research community and researchers in Diaspora. The Science and Innovation Investment Fund (SIIF) aims to support technology transfer and commercialisation of universities' research results by allocation of EU IPA IIIc funds. The Second Science and Technology Project (STP II) is launched in 2012 after successfully accomplished STP I. With the funds of about €24m in the period 2012-2015 it will improve the capacity of Croatia's R&D and innovation institutions and prepare them for projects submissions to EU Structural and Cohesion funds.

The research system in Croatia is dominated by the public R&D sector over a private sector which is technologically weak and underinvested in the domain of research and innovation. Universities play a leading role in both research manpower (80% of total researchers) and performing research activities (54% of R&D in 2012). The sector of the public research organisations (PRO) consists basically of 26 public research institutes and around 50 scientific research units classified as other legal entities (e.g. hospital research centres). The number of higher education institutions has doubled in the last 6-7 years (NCHE, 2011) and consists of 122 higher education institutions of which 7 are public universities with 67 faculties and academies.

The remaining belongs to the private schools of professional higher education. There are around 14 private research organisations which are either independent institutes (e.g. the Mediterranean Institute for Life Sciences) or belong to corporations (e.g. Ericsson Nikola Tesla).

The investments in R&D are rather low and stagnant in both public and private sector in the last three years. With the total investments in science and research (GERD) of around 0.75% of the GDP since 2010 (€330m in 2012) compared with investments of above 2% of the GDP in the EU-28, Croatia is considerably lagging behind the EU Member States. That is the lowest level of investments in research and development in Croatia since 2004 when GERD amounted to 1.05% of GDP and marked a persistent decline in R&D funding in Croatia. The Economic Programme of Croatia, adopted by the Government in April 2013, envisaged increasing in the share of GERD to 1.4% of the GDP by 2020. The amount will increase by a combination of national investments with investments through international programmes, including EU Structural funds.
The majority of GERD in 2012 (51.2%) is financed by the government while business sector contributed with the 38.8%. Investments from abroad make 9.9% of GERD while remaining 0.2% is coming from the private-non-profit sector.

The business expenditures on R&D in the last three years are also rather flat, around 0.34% of GDP (€ 151.3m in 2012) and reveals that Croatia is missing companies capable of performing and investing in R&D. About 80% of all investment in R&D and researchers in the business sector is concentrated in a couple of multinational companies while SMEs have limited technological capabilities and absorption capacities, generating only limited interest for R&D. Business sector employs around 19% of the total researchers that indicates a substantial lack of critical mass of researches needed for technological accumulation and transition to knowledge economy. Business sector invest about modest €35 per capita in R&D in 2012 (€34 in 2011) while EU invests in average almost 10 times more (€332.8 p/c). Unfavourable business environment is further discouraging the business development and research based innovation which produces a narrow export base, insufficient competitiveness and a loss of international market share.

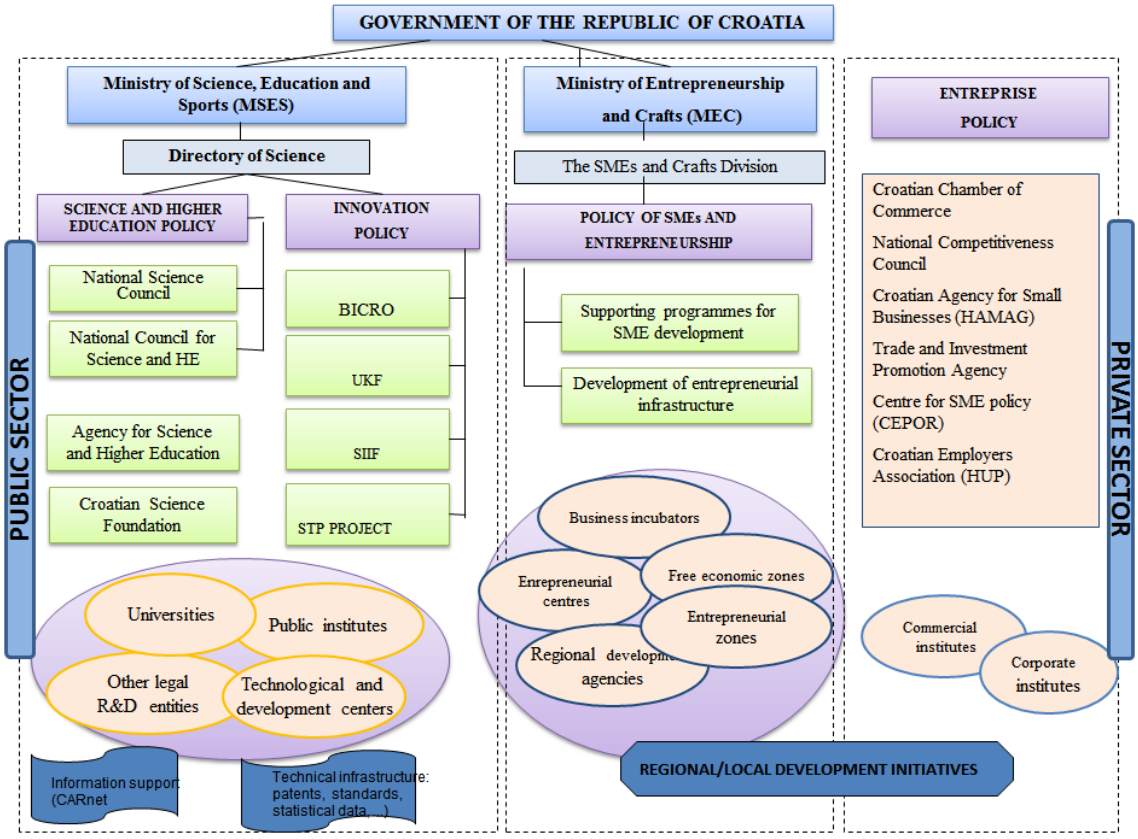
The public resources for R&D are also both low and stagnant in the last three years and amounts to around 0.42% of GDP that is far from the national target of 1% of GDP of public resources for R&D defined in the Science and Technology Policy 2006-2010. The envisaged further budget restrictions threaten the maintenance of the national knowledge base, professional expertise and education.

The number of researchers in Croatia is steadily declining during the last decade and oscillates around 6 thousands researchers (6,346 researchers in 2012). That accounts for 1.48 researchers per million inhabitants or 45% of average in the EU-27 (3,26 researchers per million inhabitants). By contrast, the number of researchers in the EU has grown in the same period for 34.4% from 1.22 million in 2003 to 1.64 million in 2012 and has doubled in some countries like the Czech Republic or Slovenia.

An explicit regional research policy does not exist in Croatia. Regional development policy exists mainly at the county level (NUTS 3) and is related to affairs of local significance such as local economic development, traffic infrastructure, education, health services and other social and cultural institutions. The lack of regional research policy stems primarily from the insufficient resources (small tax base) that would enable counties or municipalities to take a more active part

in the development of education and research institutions and activities. According to the Regional Innovation Scoreboard (EC, 2012) the entire Croatia is moderate innovator while the most developed region is North-West Croatia (due to the capital city Zagreb) which is classified as an innovation follower. However, a proactive regional policy based on convergence and competitiveness is very important because Croatia suffers from considerable and long-term regional disparities. The average incomes are three times higher in the richest regions than in the poorest ones (RCIC, 2011). The smart specialisation strategy is growingly perceived as a tool the enhancement of the regional competitiveness by identification of the specific regional innovative and technological sectors.

Figure 1: Overview of the Croatian research and innovation system



2 RECENT DEVELOPMENTS OF THE RESEARCH AND INNOVATION POLICY AND SYSTEM

2.1 National economic and political context

Croatia has been significantly affected by the global financial and economic crisis as many other European countries. In the period from 2002 to 2008 high macroeconomic growth in Croatia was mainly induced with domestic demand. In this period average annual rate of GDP increased by 5%, and then was followed by full five years of economic recession that brought economic downturn. Namely, a sharp GDP decline of -6.9% was recorded in 2009, and then followed by contraction of -2.3% in 2010 and zero per cent rate in 2011. After stagnating in 2011, real GDP fell by -2.0% in 2012. Since 2008, when the Croatian economy entered recession, economic activity has contracted by almost 12%. Overall, real GDP is expected to decrease by 1% in 2013. Domestic demand should continue to exert a drag on growth, while net exports are projected to provide limited support to overall growth. According to IMF`s World Economic Outlook Croatian economy expects to grow up by 1.5% in 2014. Since 2009, Croatia has seen its convergence gap with the EU10 and EU15 countries increase.

Croatia became the 28th Member State of the European Union on 1 July 2013. While EU entry may be expected to provide support for the economy, in the very short term the crosscurrents problems in the Croatian economy will remain a major drag on growth.

The centre-left Government elected in November 2011 has started significant economic reforms e.g. reducing budget deficits, increase of VAT at 25 %, change of personal income tax, registration of a company with only €1.3 of founding capital, increasing VAT inter-rate, introducing fiscalisation etc. Unfortunately, these reforms and the lack of investments failed to reverse the negative economic trends caused by the long-term neglect of structural reforms, particularly slow growth of foreign direct investments and crisis in the Eurozone. There are also opinions that the tight fiscal discipline, new and growing taxes, asset seizures for payment of tax and bank debts, the policy of scarcity and austerity budget for both 2012 and 2013, etc. have a reverse effect on business climate with negative feedback effect on research and innovation. People's dissatisfaction with the economic and social situation is growing as many can often no longer maintain the life standard they are used to or even afford basic goods and services. The deep economic downturn coupled with cost-cutting policy and strong financial discipline takes its toll not only on spending and employment but has a negative feedback of R&D financing and future prospects.

The process of transformation from centrally planned to market economy brought a deep structural change that had the strong impact on the labour market in Croatia, as in all of the transitional countries. Now, after more than twenty years of transition, the Croatian labour market is still not performing well and it is troubled by low participation and employment rates and, at the same time, with high unemployment rates. In the period from 2008 to 2012 registered unemployment rate has grown cumulative by 6%. In line with economic activity, labour market conditions deteriorated further in 2012. In August 2013, registered unemployment rate amounted to 18.4%, which is an increase of 0.7% compared to the same month in 2012. Current situation on Croatian labour market is characterized by low employment, high inactivity rate (war

veterans, retired people) and long-term unemployment. One of the main structural weaknesses in Croatian labour market is a mismatch between labour demands and offers. The job losses in the last five years of economic downturn (170,000 jobs have been lost) were concentrated in construction and manufacturing which hardly can be absorbed by new sectors needed for economic recovery like service and higher added value sectors.

High unemployment is combined with the high level of youth unemployment (aged 15-24). Croatia is the 3rd country with the highest share of young unemployed persons reaching 52% in the second quarter 2013 (Eurostat, 2013) while the first is Greece with 61.5% followed by Spain with 56%. A share of unemployed persons with higher educational level in Croatia is 10.4% of the total number of unemployed which indicates a strong need for reforms not only of labour market but also in the higher education sector. Croatia's high rates of youth unemployment and long-term unemployment can be partially explained by the lack of a quality structured incentives and rigidities in the labour market. Generally, there is a challenge to improve the quality of labour market, decrease the level of youth unemployment, and increase participation in lifelong learning and to improve the quality for all levels of education.

The doctoral students (who are usually perceived as human resources for knowledge economy) with the expiring employment contract in public sector (HEIs and PROs) will face significant difficulties to find job in the private sector after graduation. The budget cuts and recent reforms of research sector do not allow them to stay in the public sector which was previously a regular practice. Therefore, it is important to explore possibilities for job creation, including self-employment and entrepreneurship.

Private sector in Croatia still has limited technological capabilities and absorption capacities, generating only limited interest for R&D. This problem, along with the budget cuts for research and negative economic trends, represents one of the largest challenges for creating efficient innovation policy. Private sector invests around 0.57% of GDP in R&D, while EU average is 1.21%; this indicates a substantial lack of critical investments for technological accumulation and global competition based on knowledge and innovation.

The collapse of large state owned enterprises in the manufacturing sector during privatization and their link with research organizations, including the unfavourable structure of SME which is dominated by sectors not based on research and innovation, are considered to be the main reasons for the weak business research. Major weaknesses of business sector include: low investment in R&D, weak absorptive capacities of Croatian businesses, the lack of linkages between innovation actors, the strong concentration of R&D expenditure on relatively few companies while innovation and R&D occupy a marginal role in the development strategies of the most of Croatian companies.

Croatia is slowly closing its competitiveness gaps with the EU10 and EU15 on labour market, productivity, rule of law but the gaps are largest on innovation, technological readiness and business sophistication. With the EU accession, new opportunities are arising for Croatia, particularly through access to EU markets and increased funding for innovation.

The important factor for private investments in R&D is well-functioning business environment which is still discouraging to innovation. Research sector could not lead to innovation by itself but requires wider supporting socio-economic environment like absorption/technological capacities of companies, macroeconomic fundamentals, competition policies, transparency, overcoming corruption and similar factors which are progressing but still are not properly in place.

Despite the relatively developed infrastructure for R&D, links between science and industry are still weak. In addition, there is a lack of incentives for cooperation between science and industry, including commercialization of R&D. Croatian government is characterized by the lack of the strategic development visions which would promote research and innovation as the pillars of development. The "new industrial policy" which would provide a framework for the future of science and technology is not a matter of policy debates. Although R&D is emphasised as the key prosperity factor for economic development, in Croatia there is still lack of funding which has been justified by other priorities, such as large capital non-productive investments (e.g. sports arenas), subsidies to failed industries (shipyards, railways) and agriculture (five-fold of the EU15). The scarcity of resources for R&D in 2013 is justified by the new subsidies to shipyards, EU membership fee, interest on state loans, increase of pension funds, salaries in the public sectors and other factors.

The trends in R&D funding reveal that both public and private investments in research and innovation are fairly small and have worryingly downward trends. Research and innovation are not only constantly under-invested (below 1% of GDP) but further budget restrictions and financial crisis threaten the maintenance of the national knowledge base, professional expertise and education.

With Croatia as a new member state of European Union, the availability of EU funds grows, but also this might not ensure prosperity of economy. A major concern of development and innovation policy in the coming years as a EU member state will be to implement further reforms to create absorption capacities for EU funds and avoid being a net contributor to the EU. This membership will certainly influence on future evolvement of research and innovation and provide a new momentum for Croatian economic development and financial stability.

2.2 Funding trends

2.2.1 Funding flows

The Science and Technology Policy 2006 – 2010 has set the goal of reaching expenditures for R&D at 3% of GDP for research and development activities, with annual increase of at least 25%. However, economic downturn and low expenditures on R&D over the last several years implied the need for setting more realistic and, at least, somewhat achievable national goals. The Economic Programme of Croatia (adopted in April 2013) and the proposal of the Strategy of Education, Science and Technology (SEST, 2013), which is currently in the adoption process, defined the new goal of reaching financial allocation for R&D of 1.4% of GDP by 2020, out of which 0.7% through public financing. At the same time, new measures aimed at increasing business R&D expenditures and expenditures from other national and international sources are expected to reach 2% of GDP by 2020.

Although significantly lowered, goal of reaching R&D expenditures of 1.4% still requires significant efforts, when compared to the current situation. Expenditures on R&D have been constantly decreasing since GERD reached 1.05% in 2004, except in 2008 when GERD amounted to 0.9% of GDP. These trends reveal the existence of more complex, structural problems of the overall system, rather than just effect of global crisis and recession. Croatia significantly lags behind the EU-27 average expenditures on R&D, despite the negative economic trends in several EU countries. For comparison, EU-27 GERD reached 2.06% of GDP in 2012 and has been showing increasing trends since 2010, when it reached 2.01% of GDP.

Share of government budget appropriations or outlays on R&D (GBAORD) in total general government expenditures in Croatia amounted to 1.59% in 2012, as reported by Eurostat. This is somewhat higher than in the preceding years (1.51% in 2009; 1.57 in 2011) and higher than the EU-27 average of 1.42% in 2012. Total GBAORD amounted to €334m in 2011 (0.75% of GDP) and decreased to €318.465m in 2012, reaching 0.73% of GDP. Most of the GBAORD has been allocated to two main priorities: 48.5% for General advancement of knowledge: R&D financed from General University Funds (GUF) and 44.6% for General advancement of knowledge: R&D financed from other sources than GUF, while the remaining 6.9% was distributed among all other priorities, such as Agriculture (0.5%), Health (0.9%) and Industrial production and technology (1.1%).

Business sector funded only 38.2% of GERD in 2012, which is only slightly less than highest level of 40.8%, reached in 2008. Government sector funded 45.5% of GERD in 2012, while HEIs contributed with 1.7%. The ration of private and public expenditures of 40:60 has been almost constant since 2000. These trends indicate low participation of business sector in research and development activities, which are largely dominated by the public sector. HEIs and government sector performed around 54% of GERD in 2012, while business enterprise sector performed around 46% of GERD. For comparison, in the EU-27 public sector performed around 36% of GERD and funded around 34% of GERD in 2011.

The Government finances around 76% of research activities at HEIs (75.8% in 2012) and 84% at public institutes. On the other hand, in 2012 the Government financed only 1.2% of R&D in the business sector and the majority of R&D expenditures (65.6%) in the business sector were financed by the companies themselves, followed by 23.5% of resources that came from foreign investors. Although the share of government funding of R&D still remains quite high, it shows decreasing trends over the last years. In 2008, the government financed 81.2% of R&D at HEIs, 84.3% at public institutes and 1.8% in the business sector. In the same period, the share of foreign resources for R&D has almost doubled, from 7.9% in 2008 to 14.4% in 2012. However, the government still finances almost 44% of all research activities in Croatia.

The availability of budget resources for many research and innovation programmes still remains uncertain due to the constant budget cuts and negative economic situation in the country. Comprehensive changes in R&D funding mechanisms have been adopted (primarily the new Act on Act on Science and Higher Education and changes in the institutional setup) and are expected to bring more efficient allocation of budget resources. There are also high expectations from EU Structural and Cohesion Funds, which have become available to Croatia upon the EU accession in July 2013.

Table 1. Basic indicators for R&D investments*

	2009	2010	2011	2012	EU27 (2012) **
GDP growth rate	-6.9	-2.3	0.00	-2.00	-0.4
GERD (% of GDP)	0.85	0.75	0.76	0.75	2.06
GERD (euro per capita)	85.8	75.7	76.2	77.	527.6

	2009	2010	2011	2012	EU27 (2012) **
GBAORD - Total R&D appropriations (€ million)	312.446	324.603	334.206	318.465	90,690.521
R&D funded by Business Enterprise Sector (% of GDP)	0.34	0.33	0.34	0.34	1.3
R&D performed by HEIs (% of GERD)	32.31	28.23	27.76	26.53	23.78
R&D performed by Government Sector (% of GERD)	27.16	27.53	27.38	27.48	12.37
R&D performed by Business Enterprise Sector (% of GERD)	40.42	44.10	44.71	45.85	62.98
Share of competitive vs. institutional public funding for R&D	n.a.	n.a.	n.a.	n.a.	n.a.
Venture Capital as % of GDP (Eurostat table code tin00141)	n.a.	n.a.	n.a.	n.a.	n.a.
Human Resources in Science and Technology, as a percentage of total employment	30.9	31.7	31.2	33.4	:
HRST in high-technology sectors, as a percentage of total employment	75.0	72.6	69.7	73.8	:

	2004	2006	2008	EU-27 (2008)
Turnover from Innovation as % of total turnover *(Eurostat table code tsdec340)*	:	13.0	14.4	13.3

2.2.2 Funding mechanisms

2.2.2.1 Competitive vs. institutional public funding

The share of project based funding in GBAORD is rather small an amounted to 6.2% in 2011 and 5.6% in 2012 while remaining 93.8% and 94.4% is institutional funding. However, due to reforms in science system, driven by the need to improve the ratio between institutional and project based funding the Government adopted on 6 June, 2013 the Decision on Multi-annual Institutional Financing of Research Activities in Public Research Institutes and Universities 2013-2015 (Official Gazette 69/2013). By the Decision, the project funding provided by the MSES has been replaced by the funds for research programmes agreed between the MSES and PRO/HEI, the amount of which depends on the institutional performance indicators evaluated during the first 6 months you 2013. Due to this measure the share of project based funding increased in 2013 to 8.5% of GBAORD. The share of performance based institutional funding in total institutional funding cannot be precisely calculated since the measure is introduced six months ago.

Before this changes, the research activities were mainly financed by the State budget allocated by the MSES that usually make 80% to 85% of total research funding at public research institutes and universities, as well.. Generally speaking 70% of the allocated budget resources are spent on salaries, 10% on direct institutional funding (overheads, phone, energy, etc.), 10% on research

grants (material and operational costs) and remaining 10% is spend on other research-supporting activities (conferences, publishing, etc.)

A new type of institutional funding based on competition is related to the Scientific Centres of Excellence which will be established in Croatia for the first time during 2014 and financed by MSES. An amount of €0.330m per year was earmarked in the State budget for the 2013, 2014 and 2015, the amount that should be sufficient for the initial phase of establishing 3-5 centres while the additional funds will be probably provided by the EU Structural funds. The influence of the changes in funding system on the ratio between institutional and project funding remain to be seen in the near future.

2.2.2.2 Government direct vs indirect R&D funding[2]

In Croatia, both direct and indirect public support measures for R&D are implemented. Croatia has a relatively generous system of tax breaks for R&D, as compared to OECD countries, which corresponds to a subsidy of about 35% for US$1 of R&D, which is right behind France (42% in 2008). A recent analysis (Aralica et al., 2011) reveals that tax incentives are more generous form of state aid for R&D than subsidies. Namely, several large business R&D performers claim tax incentives that exceed the overall public R&D subsidies. Evidence can be found in corporate financial reports. For example, in 2009 subsides amounted to less than a third of aid granted by the tax incentives. Although over 270 companies used tax incentives, 90% of the total tax incentives is realized by a small number of companies: 9 in 2008 and 27 in 2009. This indicates that the a few companies conduct large research projects and the concentration of tax incentives into the small number of users is present. It is estimated that the "tax breaks tend to be irrelevant to SMEs and to favour incumbent firms to the detriment of entrants" (World Bank, 2012a). However, tax incentives prove to be of large assistance to companies and have the effects of additionally (increase the investment of companies in R&D). It is estimated that each forgone HRK generates 1.19 HRK of R&D investments but a significant number of potential beneficiaries do not use it due to concerns about excessive red tape.

When it comes to venture and seed capital, these mechanisms are still highly underdeveloped in Croatia, and do not influence the access to finance for innovative companies. Progress on improving access to finance for innovative companies has been elaborated in more detail in Section 4.2 Getting good ideas to market.

2.2.3 Thematic versus generic funding

The principles of R&D funding from the State budget have significantly changed in 2012 and 2013, orienting more towards achieving scientific excellence and quality research than in the past.

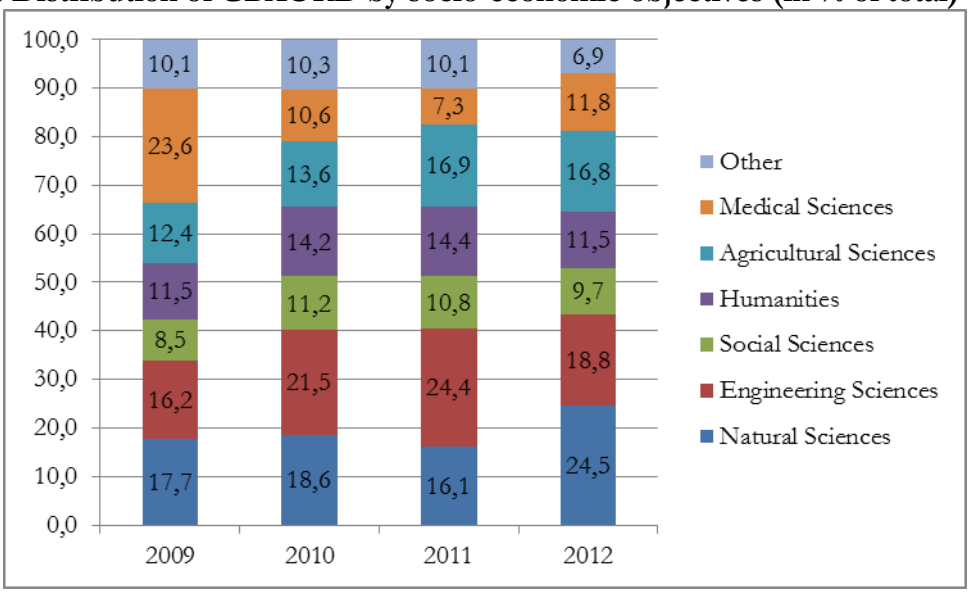
Although the overall public funding system has oriented more towards competitive funding in 2012 and 2013, the thematic priorities are still not highlighted in most of the available R&D supporting measures. Sectoral R&D policies or support to specific thematic areas are not

[2] ***Government direct R&D funding*** includes grants, loans and procurement. *Government indirect R&D funding* includes tax incentives such as R&D tax credits, R&D allowances, reductions in R&D workers' wage taxes and social security contributions, and accelerated depreciation of R&D capital.

common policy practice in Croatia. Most of R&D support measures are opened to all thematic areas and are based on horizontal approach to assure the balanced development of all scientific fields.

Allocation of GBAORD by socio-economic objectives reveals that majority of resources is allocated to two objectives – General advancement of knowledge: R&D financed from General University Funds (GUF) (48.5% in 2012) and General advancement of knowledge: R&D financed from other sources than GUF (44.6% in 2012), towards which 93.1% of GBAORD was allocated to. Both of these priorities are divided into six sub-categories: R&D related to Natural Sciences, Engineering Sciences, Medical Sciences, Agricultural Sciences, Social Sciences and Humanities. Overall, when sub-categories are analysed, regardless of sources of financing (GUF or other than GUF), in 2012 highest share of GBAORD was allocated to Natural Sciences (24.5%), followed by Engineering Sciences (18.8%), Agricultural Sciences (16.8%), Medical Sciences (11.8%) and Humanities (11.5%)

Figure 2: Distribution of GBAORD by socio-economic objectives (in % of total)



2.2.4 Innovation funding

Activities aimed at development of innovations are primarily funded through the programmes managed by the BICRO, while funding of research projects was transferred to the CSF in 2013. CSF funds are further complemented with €6.8m from the multi-annual institutional funding for research programmes provided by the MSES. Ministry of Entrepreneurship and Crafts (MEC) also manages several programmes aimed at innovation development, under the comprehensive Entrepreneurship Impulse Programme, oriented towards development of SMEs in Croatia.

When it comes to project-based funding, in 2014 a higher share of resources has been ensured for CSF programmes (€13m) than for the BICRO programmes (€5.2m). Through the MEC Impulse programme, total of €1.5m has been ensured for measure "Innovations in entrepreneurship", aimed at development and introduction of innovations in SMEs' businesses, while additional €8.5m has been allocated to the measure "Small and Medium Entrepreneurship and Crafts", mostly for co-funding of development and purchase of the new technologies and

development research activities. In the past, most of the public funding resources have been aimed at R&D activities.

However, with the changes in the overall funding system of HEIs, PROs and R&D activities, combined with the increasingly available EU funds, research and innovation funding seems to become more balanced in Croatia than in previous years.

2.3 Research and Innovation system changes

The Government elected in December 2011 initiated significant reforms of science and higher education system in Croatia driven by the need to strengthen scientific competitiveness and excellence as well as by the need to cut down the budget for R&D due to the financial and economic crisis which has put the State research budget under the strength.

The system changes are initiated by the new Act on Science and Higher Education adopted by the Croatian Parliament on 15 July 2013 which brought many changes to increase the efficiency of the R&D system. The several reforms can be singled out as the most prominent and with the far-reaching impact on the entire science system.

The first reform relates to the new model of financing scientific activities from the State budget via MSES that include a block-grant for HEI and PRO based on the Multi-annual institutional funding for research programmes. The amount of institutional funding depends on the institutional performance indicators that are evaluated during the first six months of 2013 and agreed between the MSES and PRO/HEI on a three years basis. The reform come into effect on 1 July 2013 based on the new Act and on the Decision on multi-annual institutional financing of research activities in public research institutes and universities 2013-2015, adopted on 6 June, 2013. The new funding model influences the entire system of performing of research activities since it abolishes the system of financing scientific research that has been in force since 1991 and includes allocation of competition-based project grants from the State budget through the *Z-Projects* administrated by the MSES.

The allocation of the competition based research project grants is transferred from 1st of July 2013 from the MSES to the Croatian Science Foundation (CSF) and assumes a rigid evaluation process that should end up with a small number of high quality research projects (around 20% of proposals). The CSF has become a principal funding agency or allocation of budget resources instead of MSES. The main intention is to terminate the current practice of financing a large number of small scientific projects and high acceptance rate (more than 80% of proposed projects) within the *Z-projects* programme. This request is justified from two points: /1/ to reach a critical mass of researchers and resources that would have yielded significant scientific results within the national research priorities and /2/ to provide internal responsibilities of PRO and universities for delivering research results and outcomes with the impact on socio-economic potentials.

According to the CSF's Action plan for announcing public call for proposals for research projects from July 2013 to July 2014 adopted in September 2013, only 200 projects (compared to the current number of around 2500 *Z-projects*) will be accepted for financing within the two types of research programmes: /1/ "Installation research projects" for early career researchers (50 projects in total) and „Research projects" for all other scientists (150 projects in total). The total funds allocated to CSF in 2013 for research projects amounts to around €6.8m that is only

about 40% of the previous budget funds aimed for the *Z-projects*. The government plans to increase these funds to €13.5 in 2014. The CFS funds are complemented, as mentioned previously, by another €6.8m which are coming from the multi-annual institutional funding for research programmes provided by the MSES. However, these resources cannot be used for standard research projects at PRO but should support the overall quality of research activities. 85% of these resources were allocated to the seven Croatian universities while 26 public institutes received only 15%[3]. The universities has established the Fund for the development of universities and carried out a public call at the universities' level for research projects to allocate the given resources. The systemic and integrated data on granted funds are presently missing.

Most researchers will be forced to seek funds from the European and other international funders although these funds are hardly accessible. Otherwise, they will not be able to finance their research. Apart from social sciences which are deemed as economically irrelevant, there is a threat that research in natural, medical and technical sciences will be significantly reduced, too. Therefore, it remains to be seen whether this new type of research funding will be sustainable or it will endanger a relatively small science base in Croatia (about 6,400 researchers in FTE or 47% of average in the EU-27). It is often forgotten that Croatia has a relatively narrow financial base for scientific research due to the technologically weak private sector and a lack of diversified resources for competitive research funding. With the exception of the Croatian Science Foundation, MSES used to be a single financer and consumer of R&D, and literally preserves and develops a "national science base". This base rely mainly on public R&D sector which nowadays employs 85% of the Croatian research labour force and makes a ground for overall international knowledge transfer and research-based development.

According to the Union of Science and Higher Education the proposal of the State budget for 2013 and projections for 2014 and 2015 shows a drastic reduction in funding for education and science. Allocations for MSES are reduced as a proportion of the total State budget from 9.2% in 2012 to 7.9% in 2013 with a tendency to fall to 7.6% in 2015.

Second reform refers to the launch of the scientific centres of excellence (SCE) for the first time in Croatia. The public call for establishing of the centres is carried out by the Agency for Science and Higher education (ASHE) in June 2013. The aim of the centres is to identify research groups that have the potential for a scientific discovery that could mark a turning point in scientific research. At the same time, they should be internationally relevant and aligned with national strategic needs and priorities, and objectives of the Europe 2020 strategy and the Horizon 2020. An amount of €0.330m per year was earmarked in the State budget for the 2013, 2014 and 2015. These means should be sufficient for the initial phase of establishing 3-5 scientific centres of excellence while the additional funds will be probably provided by the EU Structural funds.

Next reform relates to the Croatian Science Foundation (CSF) which has itself undergone significant organisational and programme changes. Since 1 October 2013 when the new model of research funding comes into force, all the previous programmes of CSF were (currently) terminated. They included programmes for funding basic research activities (Research projects and Collaborative research programmes), training of doctoral students (e.g. Postdoc and Fellowships for doctoral students), mobility programmes and research internationalisation (e.g. Brain gain programmes, Installation grants), international programmes (e.g. EMBO), research partnership with industry and profession terminology. According to the newly issued Action plan of the CFS 2013-2014, only two types of research programmes will be carried out in the forthcoming period: /1/ *Installation research projects* aimed at identifying a new generation of

[3] According to the MSES announcement, available at: http://public.mzos.hr/Default.aspx?art=12597&sec=1933.

researchers (scientist who obtained his doctorate degree at least 2 and no more than 7 years) and encouraging them to establish their own research groups and /2/ *Research projects* aimed at maintaining a critical mass of research groups that will be internationally competitive. The Action plan of CSF envisaged re-establishing the programmes for doctoral and postdoctoral students in 2014.

Next reform includes a takeover of the Unity through Knowledge Fund (UKF) by CSF during 2014. UKF was established in 2007 by the Ministry of Science, Education and Sports supported by the Wold bank loan within the Science and technology project. It supports collaborative research with Croatian scientists living in Croatia and abroad and leading international scientific institutions to raise absorption capacity for EU funds, especially Structural and Horizon 2020. It was estimated as highly successful Fund which established, for example, collaboration with 133 foreign research institutions including Mack-Planck Institute, Swiss Federal Institute of Technology, and Johns Hopkins University; etc. The projects financed within the Fund realized great success among the applications for call for proposals in the FP7 program for research and technological development – success thereof is in the 35% range. The Fund invested 3,6 million EUR in the acceptance of projects, and an additional 9,03 million EUR was extracted from the FP7 program, entitled to Croatian partners. In addition to the financing, success of the Fund's projects within FP7 provided Croatian research groups with international recognition, visibility and competitiveness in a worldwide scope.

This fusion follows a previous fusion of the Croatian Institute of Technology (founded in March 2006) with the Business Innovation Centre of Croatia into a new Business Innovation Agency of the Republic of Croatia – BICRO based on the Government Directive amended in 2012 (Official Gazette, 31/2012). BICRO, that was a leading institution established in 1998 to develop financial incentives and support innovation and technology-based businesses in Croatia – has itself undergone an important legal change since it was transformed from company with limited liability into an innovation agency with the status of public institution by the Government directive (Official Gazette, 129/2010). According to the World Bank (World Bank, 2012) the BICRO's transition from a liability company to a government agency is likely to have at least two negative implications: /1/ salary cuts of up to 40%, which create a severe risk of losing the cadre of highly trained professionals, and /2/ a more restrained capacity to manage multiyear budgets, which increases BICRO's dependence to the State budget cycle and contributing to the volatility of public financing for business R&D.

Finally, the fusion of the National Science Council and the National Council for Higher Education into the National Council for Science, Education and Technology Development postulated by the new Act will certainly change the landscape of the research and innovation institutional structure. The aim of this merging is to harmonize development, planning and monitoring of higher education, science and innovation systems in order to prevail the current fragmentation of the research and education systems and to strengthen integration between the sectors.

2.4 Recent Policy developments

The new Act on Science and Higher Education adopted by the Croatian Parliament on 15 July 2013 marked the beginning of the reforms in science and higher education system. It brought significant changes in the science system in terms of financing and governance of research activities and initiations, institutional landscape, organisation of research projects, promotion of

researchers into the higher scientific grades, etc. with the aim to increase the efficiency of the R&D system. The several reforms can be singled out as the most prominent and with the far-reaching impact on the entire science system.

The most noteworthy change is a shift from project to programme financing based on the new Act and the Decision on multi-annual institutional financing of research activities in public research institutes and universities 2013-2015, which was adopted on 6 June 2013 (Official Gazette 69/2013). It radically changed the system of financing research activities from the State budget which has been in force since 1991. The previous system that involves awarding of the research projects grants by the MSES through the programme Research projects (*Z-projects*) is replaced from the 1 July 2013, with the multi-annual institutional financing for research activities, the amount of which depends on the institutional performance indicators evaluated during the first 6 months you 2013 and agreement between the MSES and PRO/HEI. The government points out that this type of research financing enable the highest possible autonomy of universities and research institutes in deciding on investments in research activities.

The awarding of project research grants is entrusted to the Croatian Science Foundation and assumes a rigid evaluation process that should end up with a small number of high quality research projects, up to 200 compared to the previous number of around 2500 *Z-projects* which are terminated due to its low competiveness and scientific merits.

According to the CSF's Action plan for announcing public call for proposals for research projects from July 2013 to July, 2014 adopted in September 2013 only 200 projects will be accepted for financing within the two types of research programmes: /1/ "Installation research projects" for early career researchers to encourage home to establish their own research groups (50 projects in total) and „Research projects" for senior all other scientists to enhance their international competitiveness and mentoring competences (150 projects in total). The total funds allocated to CSF in 2013 for research projects amounts to around €6.8m that is only about 40% of the previous budget funds aimed for the Z-projects.

The governance and institutional landscape of research and higher education systems have been also significantly changed due to the fusions of several established institutions: the Croatian Institute of Technology was merged with the Business Innovation centre of Croatia into a new Business Innovation Agency of the Republic of Croatia – BICRO in 2012 (Official Gazette, 31/2012). The new Act on Science and Higher Education stipulates the merging of the Unity through Knowledge Fund (UKF) with CSF and the fusion of the National Science Council and the National Council for Higher Education into the National Council for Science, Education and Technology Development in 2014.

The institutional landscape will soon be expanded by the scientific centres of excellence, the new initiative of the Government from June 2013 to create internationally competitive research groups capable of producing radical research results.

The new Strategy for Education, Science and Technology is accomplished and publicly presented on 16 September 2013. It is based on the Guidelines for strategy of teaching, education, science and technology which was carried out by the MSES in collaboration with the Croatian Academy of Science and Arts in April 2012. The Strategy is very comprehensive and includes all the levels of educational system from primary to higher education, and adult education, as well. The last part is devoted to science and technology and emphasise the following six objectives:

1. Fast start of changes in higher education and science:
2. Internationally competitive public universities and public research institutes that create new scientific, social, cultural and economic value:
3. an environment that allows and encourages interaction and transfer mechanisms, cooperation between the research community with innovative economy and social activities:
4. Universities, polytechnics and research institutes involved in the process of smart specialization and associated guidelines technological development;
5. National research and innovation infrastructure with public access, with the inclusion of the European infrastructure and connections;
6. Growth of investment in research and development by improving the system of public financing and encouraging investments of business and social sector in research and development

The authors highlight the two main objectives of the Strategy: quality education accessible to all on equal terms, and the creation of high-quality science, competitive on a global scale of which the Croatian society must benefit. One of the major reforms includes the extension of primary schools from eight to nine years with the aim of increasing the level of compulsory education, which would come into effect in 2018.

The most recent strategic pillars for development of the national research system are provided in the Economic Programme of Croatia, adopted by the Government in April 2013 (MOE, 2013). The Programme envisaged increasing the investment in research and development to achieve a share of GERD of 1.4% of the GDP by 2020 in order to overcome the gap in science funding between Croatia and the EU countries. Croatia, with investments in R&D of only 0.75% of the GDP (in 2012), when compared with 2.06% of the GDP in the EU-27, considerably lags behind the EU Member States. The amount will increase by a combination of national investments with investments through international programmes, including EU funds. The Programme established the following four umbrella goals:

- Promotion of scientific excellence, strengthening of national innovation system and support to scientific and research activities in the public sector
- Strengthening the innovation potential and support to scientific and research activities and the development of new products and services in the private sector
- Establishing high technology network for industry and development of sectoral technological platforms
- Networking of public, private and scientific sector through clusters of competitiveness.

The "National Strategy for the Croatian innovation development 2013-2020", is still in progress although its finalization was planned for the first half of 2013. It is carried out by the Ministry of Economy which leads this process in collaboration with the Organisation for Economic Co-operation and Development (to May 2013) and local institutions. Up to now, the Draft of the Background Report which provides the basic inputs to the Strategy was publicly presented in October 2012 (OECD (2012). The Draft entails a list of strategic goals for reforming research system which are currently composed of the five main pillars and around 40 guidelines for their implementation.

The Constitutional Court repealed on 17th of July, 2013 the Ordinance on the conditions for the obtaining scientific titles which was adopted by the National Science Council (NSC) on 19th of February, 2013 (Official Gazette 26/2013). The Regulation tightens criteria for promotion of

scientists into higher scientific grades which has caused many complaints, especially among scientists from the social sciences and humanities. The Court concluded that the adoption procedure of the Ordinance was not properly implemented, and determined to apply the old Ordinance until the adoption of the new which should be in accordance with the Constitution;
However, the new Act on Science and Higher Education stipulates the new rule for promotion of scientists into the higher scientific grades. First of all, scientific titles are separated from the job positions meaning that researchers can be promoted in term of scientific title but will remain at the same job position and salary. Second, promotion into the higher scientific grades is not any more obligatory each three to five years that led to the surplus of scientists in the highest scientific grades. Instead, each scientist should pass the process of re-election every five years to evaluate whether he or she meet the requested criteria for the current job position. Third, the recruitment for the job position should be made public, preferably on the respective organisations' websites, in both the Croatian and English languages (article 19 of the Act) or by advertising job positions at the EURAXESS portal of the European Commission.

Due to the changes in the research system, all the programmes of the Unity Through Knowledge Fund (UKF) and programmes of the Croatian Science Foundation which were oriented to mobility of researchers and research internationalisation are inactive. It means that currently there are no programmes which are open to researchers from all around the world and for which no nationality restrictions are included.

However, the new International Fellowship Mobility Programme for Experienced Researchers in Croatia – NEWFELPRO is launched in Croatia in June 2013. This fellowship project was created by Unity Through Knowledge Fund (UKF) and the Ministry of Science, Education and Sport (MSES) co-financed through the Marie Curie FP7-PEOPLE-2011-COFUND programme**.** Its total value is 7 million euros, out of which 60% is financed from national sources. Project duration is from 2013 until 2017 and 83 fellowships are available. It includes three types of fellowships. The first one is the outgoing fellowship scheme which is designed for Croatian researchers who aim to improve their scientific potential by spending a period of time in top class research institutions worldwide. The next two are the incoming and the reintegration fellowship scheme directed to researchers who are presently working abroad and wish to work with scientists at public scientific institutes and universities in Croatia. Fellows are supposed to sign an employment contract in accordance with national regulations and their engagement shall also be in line with the European Charter for Researchers and the Code of Conduct.

The EURAXESS Service Centre provides all necessary information and practical support, assisting the grantees with issues regarding accommodation, health care, child care, language issues, social security, etc.

In February 2011, the Government adopted the new Action plan to Increase Absorption Capacity for Participation in the Framework Programmes (FP7) of the European Union 2013-2015. The Measure 9 of the Action plan proposes to open job positions for excellent scientists from abroad who expressed an interest in working in Croatia from national budget resources.

On December 20, 2012 MSES presented the Action plan "Science and Society", a first such document for Croatia. The Action plan is based on four interconnected, but still somewhat different thematic circles: Socially responsible science, scientific culture and education, Scientific policy and the citizens, and Science and the media.

Croatia participates in the four initiatives aimed at regional cooperation which should contribute to the cross-border interoperability of national programmes and permit joint financing of

innovation, R&D and related actions. They include: the South East Europe (SEE) 2020 strategy adopted on 21 November 2013, the Western Balkans Regional R&D Strategy for Innovation (WBRIS) for the period 2014- 2020 which is adopted on 25 October, 2013, the EU Strategy for the Danube Region (EUSDR) which is a macro-regional strategy adopted by the European Commission in December 2010 and endorsed by the European Council in 2011 and the EU Strategy for the Adriatic and Ionian Region which is in progress. Within the EUSDR the Danube-INCO.NET project will start in January 2014 which will support the coordination of funding mechanisms and funding partners in the region to develop the Danube Region Research and Innovation Fund (DRRIF) and scaling up joint funding mechanism towards a joint funding programme.

2.5 National Reform Programme 2013 and R&I

In the framework of economic and fiscal supervision, EU member states are obliged to develop documents allowing multilateral monitoring and coordination of their economic policies. In that context, during the pre-accession period (2005 - 2012), the Republic of Croatia has worked on the development of the Pre-accession Economic Program (PEP). On the eve of its accession to the EU, in 2013 Croatia elaborated on the transitional document Economic Programme of Croatia, as part of its informal participation in the European Semester 2013. Currently, as a full member of the European Union, Croatia is still working on the development of the National Reform Programme (expected by April 2014 the latest).

Accordingly, the Economic Programme currently represents the relevant document based on which national goals and achievements related to the Europe 2020 objectives can be assessed. Goals with R&I relevance primarily refer to raising investment in research and development. The main objective of measures envisaged in this area is the increase in the share of total domestic expenses for research and development to 1.4% of GDP by 2020 compared to the current 0.75% of GDP. This level is still below the EU average and does not allow the transition to a knowledge-based economy. Nevertheless, as a full EU member, Croatia has a chance to increase its level of investment into R&D by the means of EU Structural Funds. The National Strategic Reference Framework (NSRF) was approved by the European Commission in August 2013 and it defines the strategy for the use of resources from the Cohesion and structural funds.
Moreover, the Operational Programme "Regional Competitiveness" 2007-2013 should facilitate growing investments into research and innovations. Therefore, EU funds should moderate the expected further decline of the Croatian GDP in 2013. The OP Regional Competitiveness 2007-2013 anticipates development of business climate and SME competitiveness, as well as research, development and technology transfer. The objective is to provide better support to the development of competitiveness by assisting growth of productivity, reinforcement and ability to compete in international markets.
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Furthermore, improvements are required in terms of cooperation between public research organisations and the private sector that should facilitate commercialisation of research results and technology transfer process. In order to achieve this objective, several projects related to scientific and research outdated infrastructure and equipment are currently in the process of development and are supported by the relevant Ministry (technology parks, entrepreneurial incubators, innovation centres etc.). The OP Regional Competitiveness highlights the completion of the Biotechnology incubation centre and equipping all research centres and laboratories at Rijeka Campus. Improved infrastructure should facilitate growing demand for innovation in business sector, innovation and technology transfer to the SME sector, stronger

connection between entrepreneurship and R&D, decline in drain of highly qualified research workers.

Although policy developments in research and innovation were relatively stagnant during the economic crisis, which is why Croatia significantly lags behind the EU average, certain progress has been registered in terms of legislative and strategic framework such as amendments on the Act on Scientific Activity and Higher Education were adopted in July 2013, the Strategy for Education, Science and Technology adopted in November 2013 and the National Strategy for the Croatian Innovation Development 2013 – 2020 that is still in progress

In the context of promoting major domestic and foreign investments, increasing the productivity of small and medium-sized enterprises and strengthening the innovation potential, the adoption of the Strategic Investment Act is still in the process of realization. In October 2013 the Croatian Government adopted the final draft of the act. The act should primarily reduce administrative barriers and shorten the periods of implementation for major investments. However, several other measures have been previously undertaken to reduce the administrative burden and revive investment. The Act on Investment Promotion and Development of the Investment Climate supports investments and provides employment incentives in the form of tax exemptions and direct aid for job creation. In May 2013, the Ministry of Entrepreneurship and Crafts introduced the Strategic plan for 2014 - 2016, aiming towards the development of competitive entrepreneurship and crafts based on knowledge and innovations, with regards to optimal exploitation of natural resources and economic heritage. The Strategy identifies three main objectives: strengthening competitiveness of SMEs and crafts; supporting SMEs in the process of adjustment to the European market and use of EU funds; supporting and strengthening small economy through the efficient activity of the Croatian agency for SMEs and investments.

2.6 Recent evaluations, consultations, foresight exercises

The two important evaluation studies of the innovation supporting programmes were carried out in 2011 and 2012, as follows:

- The evaluation study of the Science and Technology Project (STP), a common project of the MSES and World Bank to modernise the Croatian research system was carried out in February 2012 (World Bank, 2012a);
- Evaluation of the BICRO's innovation programmes - RAZUM and IRCRO and UKF Fund which are co-financed by the World Bank in Croatia within the Science and Technology Project, carried out by the Institute of Economics in May 2011 (Radas et al, 2011).

The value of these studies is even greater because they are the first professional and independent evaluation studies of innovation policy programmes since launching the HITRA programme in 2001 which marked the beginning of innovation policy in Croatia.

According to the evaluation, the Science and Technology Project (STP) aimed to help Croatia establish and develop the institutions and programmes inherent to modern R&D and innovation systems. The project development objective remains highly relevant for Croatia's economic development and is central to the Europe 2020 Strategy and the Innovation Union flagship. The study tried to provide an answer to the interesting question – should Croatia's government prioritise public expenditures in R&D on the expenses of some other sectors. In order to provide the answer, the estimates of the rate of return on R&D compared with possible public

investments in education and infrastructure is carried out. The estimated rates of returns on R&D (73%) are at least double the value of returns on infrastructure and seven times higher than on education. Yet Croatia's aggregate R&D investments are at a relatively low level (0.9% of GDP in 2011, as compared to 3-5% in innovation-driven economies such as Finland, Sweden and Israel). It is concluded that R&D and innovation continues to hold the key to boosting productivity and securing long term development in Croatia.

The STP project enabled R&D institutions to commercialize research outputs. It also increased the ability of enterprises to develop, use and adapt technology by addressing and correcting the market failures of programmes focusing on R&D financing for enterprises (RAZUM and SPREAD). Key achievements included: /1/ more research outputs and research capacity commercialized by RTIs; /2/ improved scientific and technological cooperation; and /3/ more firms investing in R&D activities, e.g. firms co-invested €13.7m, 30% higher than the initially envisaged target of €9.2m.
After successfully accomplished STP I, the Second Science and Technology Project (STP II) has been launched in 2012.
The main conclusion of the evaluation of the RAZUM and IRCRO programmes carried out by the Institute of Economics (Radas et al, 2011) is that the programmes had a significant impact on the development of innovation, new export oriented products, science-industry collaboration and the promotion of research and innovation capabilities of the enterprises. A potential danger is the difficulty of finding funds for the commercialization of prototypes. It is, therefore, suggested to develop additional programmes that would assist companies in commercialization their new products. The UKF projects have resulted in a number of scientific papers published in international journals, initiating of the new international project cooperation and submissions to EU FP funds. The presented evaluation studies do not provide the analysis of strengths and weaknesses at national and regional level and of emerging opportunities ("smart specialisation") and market developments.
The third Ex-post evaluation of BICRO programmes RAZUM, IRCRO, TEHCRO (financed by STP) and TEST (financed by the government budget) started in October 2013 and is ongoing until end February 2014. The evaluation is supported by STP II and conducted by the international company Technopolis Austria. The aim of this process is to evaluate the design, results and impact of BICRO programmes, as well as BICRO performance in implementation of the programmes. The conclusions and recommendations of ex-post evaluation will serve as a basis to re-design BICRO programmes, improve their impact and success rate and consequently to improve Croatian innovation system.

2.7 Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3)

The National Smart Specialization (hereinafter S3) is in the initial phase and should be adopted in the middle of 2014. The Strategy is crucial for the future public support to innovation and business competitiveness at the regional level since it is a pre-condition to withdraw the funds form the European Regional Development Fund (ERDF). However, the Structural funds have become available to Croatia upon its accession to EU on 1st of July, 2013 what justify the early stage of S3 conception. It is expected that the S3 will be closely related to the enhancement of the regional competitiveness since its task is, as defined by the Europe 2020 Strategy to "identify where region can benefit from specializing in a particular area of science and technology". Therefore, the S3 receives an increasingly important role in the overall national and especially in

regional development. A proactive regional policy based on convergence and competitiveness is very important because Croatia suffers from considerable and long-term regional disparities. There is a widening gap of the socioeconomic differences and development opportunities in different parts of the country and among various social groups. The average incomes are three times higher in the richest regions than in the poorest ones (RCIC, 2011). As the result, the Law on Regional Development was adopted in December 2009 (Official Gazette 153/2009) as well as the Strategy of Regional Development 2011 - 2013 that was adopted in June 2010. An important component of regional development is the Strategy of cluster development in Croatia 2011 – 2020 carried out by the Ministry of Economy, Labour and Entrepreneurship in 2011. Clusters' development makes a good starting point for smart specialisation. In Croatia there are around 50 clusters initiatives on different level of maturity and success

Analytically important source for regional development is the Regional Competitiveness Index of Croatia, carried out for the first time in 2007 and repeated in 2010 (RCIC, 2011). According to the ranking results of three NUTS 2 regions and 21 counties, North-western Croatia is ranked first. It is followed by Adriatic Croatia in second place, then Central and Eastern Croatia in third. In the three-year period (2007-2010) the gap between the poorest and the richest counties has not been reduced. In 2007, the difference was 1 to 3.14 of GDP per capita while in 2010 the difference was 1 to 3.09 GDP per capita between the poorest counties and the richest - the City of Zagreb. According to the Regional Innovation Scoreboard (EC, 2012a) the entire Croatia is moderate innovator while the most developed region is North-West Croatia which is classified as an innovation follower. This proves the rule that the capital regions are more innovative than non-capital regions. On the other hand, it is estimated that Croatia's growth in innovation performance in the last five years has been well above EU average while innovation expenditures has increased most in Croatia in 2010 (IUS, 2011).

Therefore, support for the development of SMEs, improving economic conditions in the regions and fostering research and technologies are the pillars of S3. By the Economic programme of Croatia for 2013 (MOE, 2013), the Smart specialisation strategy will determine the targeted niches within the priority sectors in Croatia and identify unique characteristics and comparative advantages, to direct investments in research, technological development and commercialization of innovation and application of new technologies

The pillar institutions for S3 are the Ministry of Economy (MoE), Ministry of Regional Development and EU Funds (MRRFEU), Ministry of Entrepreneurship and Crafts and the Ministry of Science, Education and Sports (MSES). There is also the Agency for Regional Development responsible for the implementation of the part of the regional development policy under the jurisdiction of the Ministry of Regional Development and EU Funds.

The ground for the Smart specialization strategy is provided by the Strategy of cluster development 2011–2020, adopted in April 2011 which provides a systemic and analytical approach to identification of clusters with competitive advantages in Croatia. It is based on the clusters' mapping using the three star methodology of the European Cluster Observatory and resulted in identification of 12 priority clusters. The Economic programme of Croatia for 2013 (MOE,2013) identified these clusters with the twelve priority sectors of Croatian manufacturing industry, as follows: /1/ food processing industry, /2/ wood processing industry, /3/ car industry, /4/ maritime industry (shipbuilding and small shipbuilding), /5/ military industry, /6/ creative industry, /7/ ICT industry, /8/ textile industry and manufacture of leather and footwear, /9/ construction, /10/ health care industry (manufacture of pharmaceutical products and medical equipment), /11/ chemical industry, /12/ manufacture of electrical equipment,

machinery and equipment). The three most important clusters - food, wood and car industry are already established in January 2013.

According to the Economic programme 2013 the selected clusters/industrial sectors will be supported by development of the eight technology platforms and 4 key enabling technologies (KET). The platforms include /1/ agro-food platform, /2/ wood platform, /3/auto platform, /4/ maritime platform, /5/ energy&environment platform, /6/ (engineering, mehatronic and robotic platform, /7/ building&construction platform, /8/ ICT&creative platform. Some even added tourism, transports and logistic. The KETs include: /1/ nano sciences, /2/ bio&life-science, /3/ advance materials and photonic and /4/micro&nano electronics.

Economic programme foresees the further development of identified clusters, platforms and KETs by the establishment of the /1/ high technology network for industry including the centres of competences and /2/ Competitive clusters (MOE, 2013:74).

Although selected clusters reflect the factual strengths of the Croatian economy, there are at least three shortcomings of these initiatives: first, the identified 12 areas of clusters development are still rather broad in scope ranging from automotive to creative industries without targeting specific sectors in particular regions. It means that policy makers are still poorly equipped to identify the sectors and regions that deserved public support. Second, it is not clear which technologies are drivers of selected technology platforms and industrial network, e.g. which knowledge, scientific research or educational skills are needed to develop car, textile, energy platforms or wood, food or military industry. Finally, the selection of KETs looks more like the result of common sense than of serious analysis of factual research, business and human resources.

It points that public sector officials partly succeeded in defining priority areas, mainly those in the domain of competitive clusters and technology platforms, while selection of industrial branches and "background " technologies is yet not completed. It is illustrated by the analyses of supporting programmes for entrepreneurship and innovation which indicated that policy measures remained mostly horizontal without targeting selected sectors with the greatest growth opportunities (Bečić and Švarc, 2010).

The threat to the development of identified priority sectors in business clusters, platforms and industrial high-tech networks is a lack of knowledge about the background supportive technologies which determines the knowledge base, educational and research needs of the selected clusters and industrial sectors. It is stull undefined which technologies and consequently which research and higher education disciplines should be developed and what policy mix should be applied to encourage them.

3 PERFORMANCE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM

3.1 National Research and Innovation policy

Innovation Union Scoreboard (IUS, 2013) evaluated Croatia as a moderate innovator with a below average performance. Croatia's main strengths are in Human resources and Economic effects, while main weaknesses lie in Open, excellent and attractive research systems and Intellectual assets. Although Croatia has developed a complex research and innovation system since 2000, research, development and innovation development were not considered as national priorities until recently. In the absence of new (adopted) policies, the Science and Technology Policy 2006 – 2010 has remained as main policy in the area of R&D and innovation development. Current national and research policy can be evaluated as obsolete and lacks visionary, coherent and integrated policy framework. Two new policy documents are currently in the adoption process – National Innovation Strategy of the Republic of Croatia 2013 – 2020 and Strategy of Education, Science and Technology. These strategies are expected to bring new, more effective measures aimed at improvement of national research and innovation system efficiency.

R&D and innovations are highly under-funded in Croatia, and their budgets have been decreasing since 2009. In the period 2008 - 2012, GERD decreased from €425.5m (0.9% of GDP) to €330m (0.75% of GDP). Government funds the majority of research activities performed in the country (45.5% of GERD in 2012), with emphasis on HEIs where Government provided 75.8% of financial sources for R&D and public institutes, where Government funded almost 84% of R&D activities in 2012. Institutional funding is still a main channel for allocation of budget resources to R&D, with a share of over 94% in total governmental funding for R&D in 2012, compared to 5.89% of resources which were allocated on project-based principles. However, the share of project-based funding has increased in 2013 to 9.2% and is expected to further increase in 2014 to 9.43% in total governmental funding for R&D.

Research and development activities in business sector are mostly funded by companies themselves (65.6%), with an increasing share of financial resources coming from abroad, which doubled in the period of four years, from 11.4% in 2009 to 23.5% in 2012. Government funded only 1.2% of R&D performed by industry. Access to finance for small innovative companies and start-ups remained as one of the strongest obstacles for innovation development in Croatia. Venture capital funding is highly limited and underdeveloped. In 2012, business sector invested only 0.34% of GDP in R&D activities, which is worryingly low compared to the EU-27 average of 1.3% of GDP in the same year. By sectors of performance, public sector (comprising of HEIs and public institutes) is highly dominant and has performed 54% of GERD in 2012, opposite to the business sector that performed less than 46% of GERD.

When it comes to human resources for research and innovation, with 1.4 new doctorate graduate (ISCED 6) per 1000 population aged 25-34, Croatia is close to the EU-27 average of 1.5 new doctorate graduates per 1000 population. However, additional efforts should be invested towards

increasing the share of population with completed tertiary education. In 2012, for example, Croatia had 18.6% of population aged 25-64 with tertiary education, while the EU-27 average was much higher, reaching 27.7% of population in the same year.

Most of the researchers in Croatia (around 80%) are employed at the universities, and their number has gradually been declining over the past decade, reaching the number of 6,346 researchers in 2012 (FTE), or 1.48 researchers per million inhabitants. Therefore, Croatia significantly lags behind the EU-27, reaching only 45% of EU-27 average of 3.26 researchers per million inhabitants. At the same time, the number of researchers in the EU has grown for 34.4% - from 1.22 million in 2003 to 1.64 million in 2012 and has doubled in some countries like the Czech Republic or Slovenia.

Croatian researchers show the above average productivity, when it comes to number of research works published in national and international publications. However, if the quality of publications is observed, Croatia is significantly below the EU-27 average of 10.9% of scientific publications among the top 10% most cited publications worldwide, reaching only 3.2% in 2008.

Cooperation between science and industry is currently at very low levels, and has become recognised as one of the main development priorities in Croatia. Around 25% of SMEs are innovating in-house, compared to EU-27 average of almost 32%. In addition, there are only 27.4 public-private publications per million of population, which is almost two times lower than the EU-27 data of 52.8 publications per million of population. Patent application, community trademarks and community design applications are also considerably lower than in the EU-27, and have been decreasing over the last several years.

Share of SMEs introducing product or process innovations (30.4%) is somewhat lower than the share of SMEs that have introduced marketing or organisational innovations in their business (31.9%). However, despite the increasing awareness of importance and benefits of innovation, the share of SMEs introducing innovations has been gradually declining over the last years. Also, these indicators are significantly lower compared to EU-27, where 38.44% of SMEs have introduced product or process innovations and 40.3% have introduces marketing or organisational innovations in their businesses.

When it comes to economic effects, indicators are also significantly below the EU-27 indicators, as shown in the Table below.

To sum up, R&D and innovation development were not considered as national priorities in Croatia until recently. However, economic and financial crisis, combined with structural gaps of Croatian economy, caused significant budget restrictions and uncertain budgets for R&D and innovation support measures. There are high expectations from national strategic documents that are currently being developed (such as National Strategy for the Croatian innovation development 2013-2020, Industrial Strategy, Smart Specialisation Strategy etc.) and available resources from EU Structural Funds and R&D programmes to contribute to further development of innovations and R&D in Croatia.

Table 2 Assessment of the Performance of the National research and Innovation System

HUMAN RESOURCES	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	1.4
Percentage population aged 25-64 having completed tertiary education	18.6
Open, excellent and attractive research systems	
International scientific co-publications per million population	388
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	3.20
Finance and support	
R&D expenditure in the public sector as % of GDP	0.42
Public Funding for innovation (innovation vouchers, venture/seed capital, access to finance granted by the public sector to innovative companies)	n.a.
FIRM ACTIVITIES	
R&D expenditure in the business sector as % of GDP	0.34
Venture capital and seed capital as % of GDP	n.a.
Linkages & entrepreneurship	
Public-private co-publications per million population	27.4
Intellectual assets	
PCT patents applications per billion GDP (in PPS€)	0.62
PCT patents applications in societal challenges per billion GDP (in PPS€) (climate change mitigation; health)	0.12
OUTPUTS	
Economic effects	
Medium and high-tech product exports as % total product exports	2.98
Knowledge-intensive services exports as % total service exports	14.99
License and patent revenues from abroad as % of GDP	0.04

Data Source: Innovation Union Scoreboard 2013, Eurostat

3.2 Structural challenges of the national R&I system

The following main structural challenges are identified:

1. **The R&D policy is outdated and lacks coherent and integrated policy framework**

Under the present financial constraints, the science policy actions are focused on two goals: rationalisation of public research sector in order to achieve savings of the state budget and establishing better quality of scientific research at the same time. Ambitious agendas that aim to provide some entirely new possibilities for science in economic recovery and socio-cultural changes are not a subject of the current policy. The new industrial policy that could provide a framework for science and technology strategic role is not devised. Policy makers tend to neglect that research and innovation hold the key to boosting productivity and securing long term development[5]. The science (and innovation) policy is overlooked in favour of other politically and socially accepted priorities, such as macroeconomic stabilisation, privatisation, declined industries, public debts, etc. The science policy suffers from the lack of strategic visions that produces disorientation in policy actions. The drafts of the new strategic documents such as

5 According to the World Bank calculations (World Bank, 2012a), the social rate of return on R&D investments in Croatia is estimated to 73%, more than twice, for instance, the rate of return for infrastructure. Yet Croatia's aggregate R&D investments are at a relatively low level (0.9% of GDP in 2011, as compared to 3-5% in innovation-driven economies such as Finland, Sweden and Israel.

"The Education, Science and Technology Strategy" and the "National Strategy for the Croatian innovation development 2013-2020", have brought some new strategic recommendations.

The present science policy suffers from the lack of coordination between government bodies responsible for research and innovation policy (MSES, MoE, MoEC and MRFFEU) since their policies and supporting measures are not harmonised and related in such a way to produce a synergy in innovation and technological development.

2. Business environment is not conducive to innovation

Overall business environment in Croatia creates disincentives to innovation. Its key features include inefficient state administration (sometimes prone to political voluntarism), financial system dominated by banks (with relatively shallow and illiquid capital market), high costs of utilities and local services, widespread illiquidity and weak linkages between education sector and the labour market. According to the results of the Global Competitiveness Report for 2012-2013 (WEF, 2012) Croatia is positioned in 81th place out of 144 countries, which represents a decline of five places compared to the results for 2010. The most problematic factors for doing business in Croatia include, according to WEF, inefficient government bureaucracy, corruption, access to financing, restrictive labour regulations tax rates, policy instability, tax regulations, etc.

3. Weak interest of private companies for research and development

The volume and investment of private businesses R&D is low (around €30 p/c, while EU invests in average almost 10 times more, around €318.3 p/c). Their interest in cooperation with the public R&D sector is weak. Economy is dominated by the large and un-reformed public companies that are not exposed to market competition which would urge them to innovate. A new layer of SME is composed of sectors which are not based on research and innovation and consists largely of micro companies with less than 10 employees (92.5% of total SMEs) having modest capacities to perform or absorb research. The wholesale and retail trade sector, construction, accommodation and restaurants make nearly 50% of all SMES (MEC, 2012).
The amount of investment in R&D funded by the private business sector amounted to 0.34% of GDP, in comparison to 1.26% in the EU 27. The micro-enterprises accounted for only 1.1% of total investment in R&D by the business sector, while small enterprises accounted for a further 6.6% (MEC, 2013). These are among the lowest figures recorded for European countries. On the other hand, the share in total business investment in R&D coming from medium sized enterprises is higher than in most other European countries. The previous analyses (MEC, 2012) indicate that, overall, SMEs invested less than 1% of total revenues in research and development, an amount of around €88 million in 2008.
There is a strong concentration of R&D expenditure on relatively few companies while innovation and R&D occupy a marginal role in the development strategies of the most of Croatian companies. Innovations are mainly incremental and forced by survival on the domestic market rather than a result of meaningful and long lasting strategy for competition on international markets.

4. Sluggish reforms of research and higher education system

The governance, organisation and the financing of the research and higher education sectors remained largely un-reformed. The Croatian universities are fragmented into a large number of autonomous faculties with considerable individual power which obstruct the legal and financial integration of universities. It also makes strategic development of universities difficult, poorly

adaptable to international competition and reduces opportunities to succeed in a wider European and international environment. While the commercialization of education is raising threatening teaching as the basic university mission, there are many obstacles to research commercialisation and efficient science-industry cooperation.

However, the new Act on Science and Higher Education adopted by the Croatian Parliament on 15 July 2013 marked the beginning of the reforms in science and higher education system. It brought significant changes in the science system to improve international recognition and competitiveness of the Croatian research groups and institutions and to gain the value for the invested public money by increasing the social responsibility and economic accountability of PRO and HEI.

The most noteworthy change relates to the new model of financing scientific activities which include institutional funding for multi-annual research programmes based on performance indicators and allocation of competitive research grants by CSF that involve rigid evolution procedures to finance a small number of high quality projects. On the other and some reforms have not been accepted such tightening the criteria for obtaining scientific titles

5. Weak regional research and innovation system

Croatia suffers from considerable and long-term regional disparities since the average incomes are three times higher in the richest regions than in the poorest ones. The difference is about 1% to 3.1% of GDP per capita and do not decrease (RCIC, 2011). That calls for strengthening the active regional research and innovation policy which is currently almost non-existent. A boost is expected from the ERDF funds from two financial perspectives 2007-2013 and 2014 -2020 and the National Research and Innovation Strategies on Smart Specialization (S3) which is pre-conditionality for the use of the Fund.

3.3 Meeting structural challenges

Challenges	Policy measures/actions[6]	Assessment in terms of appropriateness, efficiency and effectiveness
1. 1. The R&D policy is outdated and lacks coherent and integrated policy framework	The new Strategy for Education, Science and Technology is adopted in November 2013; The "National Strategy for the Croatian innovation development 2013-2020", is adopted; Economic Programme of Croatia is adopted by the Government in April 2013; The Programme of the new government for the mandate 2011 – 2015 is adopted in 2011 emphasizes education and science as the key elements in the	The former Science and Technology Policy 2006 – 2010 was not implemented in an adequate way, despite its expiration in 2010. The new "Strategy for Education, Science and Technology" and the "National Strategy for the Croatian Innovation Development 2013-2020 have not brought up some important new insights that could serve to define a radically new approach to fostering innovation and productive use of knowledge. Economic Programme of Croatia envisaged increasing the investment in research and development to achieve a share of GERD of 1.4% of the GDP by 2020 in order to overcome the gap in science funding between Croatia and the EU countries (0.75% of GDP vs. 2.06% of GDP) Although all the governments since 2000 emphasize R&D as the key prosperity factor and promise to catch up with research investments at least to the average level of the EU, this goal is practically dropped out. Lack of funding is justified

6 Changes in the legislation and other initiatives not necessarily related with funding are also included.

	development of economy and society.	by investments in other priorities like large capital (usually non-productive) investments, subsidies to failed industries (shipyards, railways) and agriculture, payment of interest on state loans, etc. The policies suffers from the lack of coordination and harmonisation between government bodies responsible for research and innovation policy (MSES, MoE, MoEC and MRFFEU) in such a way to produce a synergy in innovation and technological development.
Business environment is not conducive to innovation	State administration reform has been initiated but it has progressed very slowly. Anti-corruption activities have improved the quality of business environment. Government attempted to fill in the gaps in the availability of credit and equity financing (through programmes of the Croatian Bank for Reconstruction and Development and co-financing of equity Funds for Economic Cooperation). EU accession and implementation of regional (NUTS 3) development strategies for the period 2011 - 2013 provide some stimuli to innovation policy development.	Government elected in 2011 started many reforms in order to improve business climate, but reforms have so far been insufficient to eliminate the structural rigidities that hamper the country's growth potential. Due to the complexity of business environment, policy response needs to be comprehensive and coordinated. In the case of Croatia, policy response has been fragmented and partial. Consequently, it has not reached the required level of appropriateness, effectiveness and efficiency. State administration reform and further anti-corruption efforts remain as important task for the new government. The availability of credit and equity financing for innovation is still insufficient. Policy inertia and opposition from vested interests have contributed to the current stalemate in restructuring process of economy and needed reforms
3. Weak interest of private companies for research and development	The Croatian SME Observatory Report 2012, was carried out for the first time in 2012, followed by the Observatory for 2013; The main policy instrument for upgrading SMEs is the programme of grant schemes, "Entrepreneurial impulse" carried out by the Ministry of Entrepreneurship and Crafts (MEC); Key innovation policy measures (e.g. Proof of Concept, IRCRO, and RAZUM) aim to increase R&D and technology capabilities; Tax exemptions have been introduced in order to facilitate R&D expenditures in companies.	The Croatian SME Observatory Report for 2012 and 2013 (MEC, 2012;2013) presented many important features of SME sector in Croatia including very modest investments in innovation and R&D. The MEC programme - Entrepreneurial impulse –is aimed at upgrading business infrastructures, foster uniform regional development, develop SMEs and clusters, encouraging the implementation of innovations and new technologies, etc. These efforts are not coordinated very much with the efforts of the Ministry of Science, Education and Sports (MSES).In 2011 the MEC received 5,400 applications and awarded grants of a total amount of 167.8 M HRK. In 2012, the number of applications almost doubled (40% or 11,079 grant applications). However, there is no evaluation about the efficiency of the programme and impact on development. Government's growth program which is based mainly on increasing investment by state-owned enterprises can be offset by weak private demand, given high unemployment and unfavourable credit conditions. The policy measures for fostering R&D in SMEs under the responsibility of MSES have been appropriately designed. Evaluation studies related to RAZUM and IRCRO undertaken by the Institute of Economics indicates that these measures contribute to increases in R&D activities. Proof of concept has proved as very successful programme. Effectiveness of policy measures is constrained by their limited budgets.

		Tax exemptions are mostly claimed by medium-sized and larger companies, as it has been elaborated by the Institute of Economics. This measure is appropriate, efficient and effective. It been particularly important for international competitiveness of several Croatian subsidiaries of transnational corporations. Tax exemptions are conducive to their parent companies allocating their R&D budgets to Croatia.
4. Sluggish reforms of research and higher education system	The new Act on Science and Higher Education was adopted on 15 July 2013; The public call for grants for scientific centres of excellence (SCE) has been launched for the first time in 2013; The Decision on multi-annual institutional financing of research activities in public research institutes and universities 2013-2015, was adopted on 6 June 2013 (Official Gazette 69/2013); Internal and external quality assurance mechanisms are being developed through activities of the Agency for Science and Higher Education; Technology transfer institutions and mechanisms are being facilitated through Science and Innovation Investment Fund. Intellectual property rights regime at universities is not sufficiently regulated.	The governance, organisation and the financing of the research and higher education sectors remained largely un-reformed especially in the domain of universities which are fragmented into a large number of autonomous faculties with considerable individual power which obstruct their legal and financial integration. The new Regulation on conditions for obtaining scientific titles (Official Gazette 26/2013) which has tightens criteria for obtaining scientific titles was repealed by the Constitutional Court. The Decision on multi-annual institutional financing radically changed the system of financing research activities from the State budget which has been in force since 1991. The awarding of project research grants is entrusted to the CSF and assumes a rigid evaluation process that should end up with a small number of high quality research projects, up to 200 compared to the previous number of around 2500 projects funded by MSES.. This can jeopardize national scientific base since Croatia has a relatively narrow financial base for scientific research due to low interest of private sector and a lack of diversified resources for competitive research funding. Science and Innovation Investment Fund is the only one mechanism for the facilitation of the Technology Transfer institutions and mechanisms. Technology transfer Institutions and mechanisms have been facilitated through variety of sources (both international and domestic). However, their level of funding is inadequate to achieve satisfactory results. Underdeveloped intellectual property rights regime and fragmented support to technology transfer through Science and Innovation Investment Fund are unlikely to bring about efficient improvements. Labour Act on the national level established a basic set of rules for dealing with employee inventions and technical advancements, while Copyright and Related Rights Act establish rules for dealing with employee copyright issues. These rules consequently apply to all University employees.

5. Weak regional innovation systems	The Law on Regional Development was adopted in December 2009 – the first act that systematically address the issues of regional development in the whole national territory; The Strategy of Regional Development 2011 - 2013 that was adopted in June 2010; The Strategy of cluster development in Croatia 2011 – 2020 is adopted in 2011; The National Research and Innovation Strategy on Smart Specialization (RIS3) is in progress and should be accomplished in 2014; Regional development strategies (at NUTS 3 level) for the period 2011 - 2013 include measures related to research and innovation - usually through enterprise development, science-industry cooperation and development of technology infrastructure.	None of these documents dealt specifically with research policy since it is coordinated by the MSES at the central state level. Local communities and regions do not have sufficient resources for R&D. The improvements in regional development policies and EU accession have had a beneficial effect on policy framework. Due to IPA, a total of 29 regional and local development agencies at the level of all the counties and several cities are established. They want to attract private investment, EU funds, create new jobs, etc. Regional innovation actors have become more coordinated than in the past. However, it is too early to assess efficiency and effectiveness of these developments. An expert group for carrying out the National strategy on smart specialisation is appointed by the Ministry of economy. The realization of the strategy should attain a high priority since it is a condition for the withdrawal of funds from ERDF and is perceived as the most important driver of regional development. The NUTS regions were last revised in August 2012 when the three NUTS regions are substituted by only two regions: the Continental and the Adriatic Croatia. This new division was applying from 1 January 2013 in order to use efficiently the Structural and Cohesion funds of the EU.

4 NATIONAL PROGRESS IN INNOVATION UNION KEY POLICY ACTIONS

4.1 Strengthening the knowledge base and reducing fragmentation

Promoting excellence in education and skills development

The research system in Croatia is dominated by the public R&D sector over a private sector which is technologically weak and underinvested in the domain of research and innovation. Universities play a leading role in both research manpower (80% of total researchers) and performing research activities (54% of R&D in 2011).
The number of higher education institutions in the Republic of Croatia has doubled in the last 6-7 years, while the number of academic programmes has tripled (NCHE, 2011). Today there are 122 higher education institutions of which: 7 public and 3 private universities, 67 faculties and academies, 2 private and 13 public polytechnics, 27 private and 3 public schools of professional higher education. There are around 14 private research organisations which are either independent institutes (e.g. the Mediterranean Institute for Life Sciences) or belong to corporations (e.g. Ericsson Nikola Tesla).

The number of researchers in Croatia is steadily declining during the last decade and oscillates around 6 thousands researchers (6,346 researchers in 2012) (in FTE). That accounts for 1.48 researchers per million inhabitants or 45% of average in the EU-27 (3.26 researchers per million inhabitants). By contrast, the number of researchers in the EU has grown in the same period for 34.4% from 1.22 million in 2003 to 1.64 million in 2012 and has doubled in some countries like the Czech Republic or Slovenia.

The number of students increased by 2.8% in the period 2010 - 2012, from 149,900 in 2010/2011 to 152,857 in 2011/2012 or 35 students per thousand inhabitants, while EU-27 has in average 39 students per thousand inhabitants. The share of female students was 56.8% in 2012 which was a stable number compared to the previous year.
By the estimation of the National Competitiveness Council there is a need to raise the number of highly educated persons to at least 35% of population, because the current number of graduates is almost three times less than the number required for faster economic growth.

About 60% of the total number of students is engaged in social sciences and humanities, 25% are in technical sciences, while the proportion of students enrolled in programmes of biomedical sciences and the natural orientation are well below 10% for each of these areas.

The number of graduates in technical and medical sciences is constantly decreasing since 2000 while the share of graduates in social sciences and business has been enlarged for 10%. Majority of university students graduated in social sciences, business, law, and training. The distortion towards these fields is related partly to the establishment of the private professional schools

which mainly established in "lucrative" areas such as economics, management and business. However, less than 6% of study programmes and less than 7% of all students are on the private higher education institutions. Therefore, a process of shifting the entire higher education from technical and natural sciences towards social sciences is a also a consequence of expansion of social faculties with the consent of the State.

Although the mass higher education is present all over the Europe there is awareness that the quantity, is often at the expense of quality. The increase in Croatia is caused mainly by many new private high schools in the field of economics and management that produce professions which do not always comply with the requirements of the labour market.

Labour markets itself remain largely unreformed and is shrinking due to the economic crisis while the higher education system does not contribute to reductions in skills mismatch. Croatia is the 3rd country with the highest share of young unemployed persons reaching 36.1% in 2012 while the first is Greece with 54% followed by Spain with 53% of young unemployed persons. A share of unemployed persons with higher educational level is 10.4% of the total number of unemployed. Many of them are young people without work experience whose unemployment is identified as the most critical problem of the labour market in Croatia. To boost employment of high educated youth, the Government started a special Measure of professional training for work without employment for young people with a university degree or specialized professional studies in May 2012. Yet, higher educated young people often seek jobs abroad or try to survive through social remittances and reliefs in unemployment.

Croatia is a country with the higher number of young persons with at least uppers secondary education in Europe, since more than 95% of the population aged 20-24 completed some kind of upper secondary. The two third of youth population aged 18 enrolled the higher education system. The future of Croatia depends on establishing such a system which will enable these young people to complete higher education and use their skills in productive way. Presently the percentage of population aged 24-64 with tertiary education in Croatia is 24.5% while in the EU 27 is 34.6% (IUS, 2013).

The share of doctors of science in the population is very low and amounts to 0.3% of population as reported by the EUROSTAT in 2009. The national target is to increase their share to 1% of population in the next 10 years. The number of new PhDs under 35 years is not significantly behind the European average (RH- 1.4 and EU 1.5 PhDs per thousand inhabitants in 2010). However they are insufficient in natural science, technological, technical and mathematical disciplines (40%), and very few PhDs employed in the business sector (estimated at around 15%) (SEST, 2013).

The share of persons aged 25-64 engaged in life-long learning (LLL), reported by EUROSTAT for 2012 is 2.4% while in the EU 27 is 9%. Croatia significantly lags behind countries such as Finland, Denmark and Switzerland that have over 25% of the population involved in LLL.

The mobility of the university teaching staff is not very strong due to traditional closeness of the Croatian universities. However, the mobility of student is improving. According to UNESCO statistics, a total of 6,861 Croatian students are enrolled in degree programmes at universities abroad in 2009 (of which 80% in the EU and in the United States). By UNESCO data the

outgoing student mobility rate of the Croatian students is 4.93% (by Eurostat 3.51%). Hereby Croatia as a country with an above average rate of outgoing student mobility.

Based on the questionnaire administered by the MSES in January 2010, higher education institutions in Croatia estimate that in the 2011/2012 academic year they will have a total of 1,036 outgoing students (0.6% of total number of students). The expected number of hosted students in the same academic year is 360 foreign students, mostly within 4th framework of ERASMUS programme.

The percentage of inflow of foreign students to Croatia is low (2.49% of total students) while the share of outflow students is 4.58% of total students as reported by Eurostat in 2011).The data about mobility of researchers and university teachers are rather insufficient in Croatia and a comprehensive database or system for monitoring and collecting data on researcher mobility does not exist. Only the University of Zagreb maintains a web-based database on academic mobility but the detailed data are not readily available.

In the area of an open labour market for researchers Croatia has made a big progress in the last two years by adoption of the Action Plan for Mobility of Researchers 2011-2012, Action Plan for Overcoming Obstacles and Enhancing International Mobility in Education for the Period 2010-2012 and the Action plan to Increase Absorption Capacity for Participation in the Framework Programmes (FP7) of the European Union 2013-2015. The main aim of the first Action plans is to remove obstacles for the international and inter-sectorial mobility, while the second one recommends to grant work permit for teachers within LLL programme of the EU. The third Action Plan goes a step further and recommends granting the scientific jobs for exceptional scientists from abroad regardless their nationality and citizenship (the measure number 9).In addition, the "Scientific visa" is in implementation in Croatia since 2009. It simplified entry of foreign researchers and have greatly facilitated researchers' mobility and international cooperation in Croatian science. However, the practical implementation of the documents is hindered by various obstacles and rules which are not visible at first sight.

Since 2008 the three Ordinances on Determining the Requirements for Granting Temporary Residence to Foreigners for the Purpose of Scientific Research (Official Gazette 42/08; Official Gazette 92/12; Official Gazette 22/13) were adopted which significantly simplified the participation of foreign scientists in research activities in Croatia and receiving the work posts.
The aforementioned action plans and the new Law on Science and Higher Education adopted by the Government on 1 February 2013 (article 19) recommend that the procedures on recruitment have to be made public, preferably on the respective organisations' websites, in both the Croatian and English languages. The transparency of employment of foreign researchers has been improved through advertising job positions at the EUROAXSES portal of the European Commission. According to the researchers report for Croatia in 2012 carried out by the Deloitte, the number of researchers posts advertised through the EURAXESS Jobs portal per thousand researchers in the public sector was 37 in Croatia compared with 8 among the Innovation Union reference group and an EU average of 24. As of June 2011, 328 publicly funded research jobs had been published on the EURAXESS portal and 88 research organisations from Croatia had registered for this activity.

A prominent role in international mobility has the researchers' mobility network in Croatia – EURAXESS which provide through the EURAXESS portal much useful information on life and work in Croatia and offers assistance for researchers and their families about accommodation, childcare, healthcare, social security, work permits, taxation, etc. It also provides information on research position in Croatia and about administrative procedures. The fourth edition of a

Foreign Researcher's Guide to Croatia has recently been published by the Agency for Mobility and EU Programmes.

In Croatia, publicly funded grants or fellowships are not portable to other EU countries. However, Croatian Science Foundation (CSF) used to carry out two programmes (Postdoc and Installation grants) which are open to researchers from all around the world and no nationality restrictions are included. The only obligation is that the research activities and host research centres are located in Croatia. The similar programme - Crossing Borders Grant - is implemented by the Unity Through Knowledge Fund (UKF) that supports medium-scale collaborative research projects in Croatia with involvement of scientific and research Croatian Diaspora. Currently these programmes with no nationality restrictions are changing in scientific system. Participation of foreign researchers is considered as an advantage on the new projects managed by the CSF, currently under evaluation, but they cannot be paid for their work because the eligible costs include only operational costs of research.

By March 2013, 37 research and higher education institutions have signed the Declaration of Commitment to the Principles of the Charter and the Code. The self-assessment analyses revel that the main principles of the Charter end Code are already incorporated in the national legislation and internal regulations of individual institutions. However, there is still room for improvements and changes to make regulation and practices fully compliant with the Charter and the Code. In addition, 14 institutions received acknowledgement and logo by the European Commission for the "HR Excellence in Research".

The career development is currently possible through the new International Fellowship Mobility Programme for Experienced Researchers in Croatia co-financed through the Marie Curie FP7-PEOPLE programme started in June 2013.

Reform of doctoral studies was conducted in Croatia within the implementation of the Bologna process, especially in period 2004-2008. During this period the Croatian Science Foundation implemented a programme "Higher education reform" that consisted of 5 sub-programmes: Learning Outcomes-Based Higher Education, Integrated University and Integrated Tertiary Education System, Development of Institutional Quality Assurance Units, Development of Joint Studies and Development of PhD Programmes.

Today, the Foundation implements two programs for the advancement of doctoral studies: Fellowships for doctoral students and National Training Courses and Summer Schools for Doctoral Students. Although these programmes improve doctoral training they do not bring significant innovation in the doctoral studies.

The Croatian declaration of open access which was initiated in October 2012 was signed by more than 500 researchers in a couple of months. The open access is enabled by the University Computing Centre (SRCE) which provides communication and information infrastructure (e-infrastructure). Croatian Government encourages open accessibility to the results of publicly funded research by the Croatian scientific portal, a project that marked the beginning of OP in Croatia in 2006. The Portal combines, in one place, information about Croatian scientists, their papers and research projects, Croatian journals and scientific instruments. The aim is to provide better interconnection between scientists as well as promotion and popularisation of science in Croatia and abroad. The Portal provides several informational services which afford open access to all scientific information resulted from public funding research, as follows: the Croatian scientific bibliography - CROSBI, the Croatian scientific journals portal – HAMSTER and the

Who's who in Croatian science. For example, HAMSTER provided by October 2010 access to 222 journals, 4121 issues and 54163 full text articles.

International research cooperation including the cooperation with the third countries in Croatia is based on bilateral and multilateral international agreements and implementation of cooperative programmes. The international collaboration of educational, academic and scientific institutions involves the exchange of different forms of scholarship in all categories, the implementation of common scientific research projects and organizing international conferences and seminars.

Research cooperation is mainly based on the bilateral programmes in line with the common interests and the priority areas of the countries involved. The Ministry supports bilateral research project on the two-year basis with the following countries: Albania, Austria, France, India, China, Hungary, Macedonia, Germany, USA and Slovenia.

Research Infrastructures

Croatian research infrastructures are mainly national in character and dominated by the small-scale research equipment scattered among HEI and PRO.
Croatia is a member of ESFRI (European Strategy Forum on Research Infrastructures) since October 2010 and participates in the four related projects: CLARIN, DARIAH, ESS and since January 2012 in SERSCIDA.CLARIN is devoted to establish an integrated and interoperable research infrastructure for the language technology needed in SSH research, DARIAH supports digitally-enabled research across the humanities and arts and ESS analyses attitudes, beliefs and behaviour patterns of diverse European populations. SERSCIDA is focused on social science data archiving and open access.
Ministry of Science, Education and Sport opened public consultation on the Draft Development Plan of the Scientific Infrastructure in Croatia. The Plan identifies priorities for investment in scientific infrastructure at the national and pan-European level and defines the criteria for selecting projects. It is important to note that this is a document that needs to be updated regularly, in accordance with the guidelines in key strategic documents - the Strategy for Education, Science and Technology, the National innovation and Smart specialization strategies. The goal of public hearings is to gather comments of the interested public on the proposed document.
Croatia has not applied a strategic approach and policy objectives and strategies in accessing intergovernmental European infrastructures. Access to the national research infrastructure within the scientific institutions is organized by the Agency for Mobility and European Programmes. Regarding inclusion into Inter-governmental research organisations, as a result of multilateral agreements Croatia is a member of the European Molecular Biology Organization (EMBO), Conference and European Centre for Medium-Range Weather Forecasts as well as engaged in program of the European Organisation for Nuclear Research. In addition, Croatia has the accesses to the large international research infrastructures like CERN, EMBL (European Molecular Biology Laboratory, EUMSTAT (EU meteorological satellites) through the membership and research collaboration. For example, the participation of the Croatian scientists in CERN is defined by a separate memorandum. Co-financing of participation is made on functional basis, meaning that the MSES's financial contribution is provided only for the special experiments. It is considered very favourable because it pays only actual work, rather than formal membership. Presently Croatia participates in the following projects: ALICE, CMS, LHC, OPERA and CAST.

Croatia participates in the MERIL project (Mapping of the European Research Infrastructure Landscape) which provides through the MERIL portal an inventory of the most excellent research infrastructures (RIs) in Europe. The five infrastructures from Croatia are included: Cloud Infrastructure Services (IaaS): Virtual Computing Lab/ Virtual Private Servers, Croatian National Grid Infrastructure, Data Infrastructure Services, Institute of Oceanography and Fisheries, and Isabella Cluster.

The MSES supported the establishment of the Croatian National Grid Infrastructure - CRO NGI, which operates in accordance with the European network. Part of CRO NGI infrastructure is connected to the Worldwide grid infrastructure European Grid Infrastructure (EGI).

According to the Strategy of Education, Science and Technology (SEST, 2013), a Croatian strategic forum for research infrastructure (CFRS) will be established in areas in which Croatia has a critical mass of scientists and connected to the existing ESFRI. The needed funds membership will be also provided.

4.2 Getting good ideas to market

Improving access to finance

Despite increasing orientation of national and regional development strategies and programmes towards research and innovation activities, financial sources for innovation funding remain scarce. Venture capital and equity finance are still highly underdeveloped, leaving start-ups to orient towards bank lending and leasing mechanisms, usually reluctant to provide finance to risky investments.

There are nine credit guarantee schemes administered by Croatian SMEs agency HAMAG Invest, out of which one is oriented towards development of new technologies. The percentage of the guarantees varies, covering up to 70% of the credit for microcredits and new entrepreneurs (OECD, 2012b).

Business Innovation Agency of Croatia (BICRO) developed several support measures in 2007, aiming at providing funding to innovative SMEs, supported through the World Bank loan (Science and Technology Project), including Development of Knowledge-Based Companies Programme – RAZUM and Venture Capital Programme – VENCRO, an public-private partnership initiative to encourage potential fund managers to start venture capital funds in Croatia. However, difficulties in finding an appropriate private partner prevented the actual implementation of the measure. RAZUM programme provides financing to start SMEs for projects at a pre-commercial development phase. In the period 2007-2012, 24 projects have been approved for funding from the RAZUM programme, with contracted funding of € 15 million.

The Proof of Concept (PoC) Programme, also administered by BICRO, is the newest policy measure introduced in 2010. The programme was created to ensure pre-commercial capital for technical and commercial testing of innovation concepts. So far, PoC has achieved significant results in terms of the number of applications and the quality of applied projects. Its evaluation procedures are transparent and effective, which is one of the reasons for the continuous increase in the number of applications.

Main barriers for development of innovation and entrepreneurship in general include complex administration, unnecessary bureaucracy, long and complex procedures to obtain necessary licences as well as high regulatory fees. Selection criteria of significant part of implemented support measures are vague, making the applications more difficult to prepare and selection process more dependent on evaluators' subjective appraisal. Evaluation procedures remain rather underdeveloped, but some improvements have been made towards ensuring effective evaluation of implemented programmes and their revision based on the evaluation results, as described in Section 2.6.

Protect and enhance the value of intellectual property and boosting creativity

Intellectual property protection in Croatia is rather well regulated and falls under the responsibility of the State Intellectual Property Office (SIPO). The development course of the intellectual property system in Croatia has been set by the National Strategy for the Development of the Intellectual Property System of the Republic of Croatia for the period 2010 – 2012, which identifies the following strategic development goals:

(1) The adaptation of the legislation framework in the field of intellectual property rights by its harmonisation with the EU acquis communautaire and international legal order in the field of intellectual property;
(2) Improvement of the national intellectual property system (NIPS) institutional framework, primarily through the development of institutions, modernisation of methods and procedures, development of human resources and increasing the level and transparency of cooperation between stakeholders in the NIPS;
(3) Improvement of the national intellectual property infrastructure and its integration into the global one;
(4) Improvement of the use of intellectual property;
(5) Increasing the level of recognition and respect for the IPR through raising public awareness about the importance of intellectual property and increasing the efficiency of the legal enforcement of rights;
(6) Regional and global integration of NIPS and active international cooperation.

SIPO information centre – INCENTIVE, was developed as a result of a CARDS 2003 project Intellectual Property Infrastructure for the R&D Sector – Promoting research institutions – SME interactions. Through the INCENTIVE, SIPO provides professional information assistance, services and educational programs intended for universities, public research institutes, and business sector (SMEs) with the aim of effectively protecting, utilising or managing intellectual property.

There have been no recent initiatives aimed at protecting and enhancing the value of intellectual property and boosting creativity. There is a need for introducing additional supporting mechanisms and regulation in the area of IPR on Croatian universities. This specific area is stipulated by the Labour Act, which primarily regulates inventions and relations between the inventor (employee) and employers and provides the rights of appropriation to the employers. In practice, the higher education institutions are provided with free disposition of the intellectual property rights, resulting in low levels of spinouts and start-ups creation.

Public procurement

Public procurement procedures are based on the Public Procurement Act, which does not distinguish innovative goods and services from other goods and services. In addition, no innovation-oriented procurement policies exist in Croatia. In general, development of innovation

was not recognised as one of national development priorities until very recently. Draft of National Innovation Strategy does recognise the need of using specific procurement procedures to boost development of innovation. However, the final NIS has not been developed yet, and specific measures enabling the development of public procurement procedures serving innovation development have not entered into force.

4.3 Working in partnership to address societal challenges

Croatian participation in European Innovation Partnerships (EIPs) is rather limited. Under the European Innovation Partnership (EIP) on Active and Healthy Aging, Croatia participates in 20 initiatives, out of which 12 are currently active and another 3 are expected to start in the period 2014 – 2015. There are 22 Croatian cities listed in the SmartCities and Communities Platform, but no Solution Proposals have been submitted regarding Croatian cities so far. When it comes to EIP on Water and EIP on Raw Materials, there are no data on participation of Croatian institutions in the initiatives.

However, Croatian institutions actively cooperate with Joint Research Committee on 11 Framework Programmes projects, 3 cooperation agreements and 2 scientific networks. These institutions include Croatian Society for Radiation Protection, Institute of Oceanography and Fisheries, Meteorological and Hydrological Institute, Ministry of Science, Education and Sports, Children's Hospital Srebrnjak, State Office for Radiological and Nuclear Safety, Ruđer Bošković Institute and Institute of Social Sciences Ivo Pilar. Areas of cooperation include number of areas, including climate, impacts of climate change on air pollution systems for flood warnings, integrated management of coastal zones, information on soil ecosystem biomass, minerals, nanoparticles, radiological data exchange, food allergies and regional policy coordination scientific and technological cooperation.

The new Strategy for Education, Science and Technology from November 2013 aims to create conditions for research and innovation focused on excellent science, industrial leadership and societal challenges. It also aims to create conditions to provide high-quality education to all on equal terms and to enable science to contribute to job creation and socio-economic prosperity

4.4 Maximising social and territorial cohesion

The Strategy on smart specialisation (S3) is perceived in Croatia as a crucial tool for the future public support to innovation and business competitiveness at the national and regional level through the European Regional Development Fund (ERDF) which have become available to Croatia upon its accession to EU on 1 July 2013. The proactive regional policy based on convergence and competitiveness is very important because Croatia suffers from considerable and long-term regional disparities. By current data, the average incomes are three times higher in the richest regions than in the poorest ones (RCIC, 2011). Counties or municipalities do not take a more active part in the development of research and innovation activities die to their weak research and technological potentials because of the insufficient resources, coming from the small tax base that would enable. It therefore speaks in favour of more general state support for social and territorial cohesion. Structural funds might bring radical changes to regional development which promotes the S3 into the top priority policy issue.
Croatia started to use Cohesion and Structural Funds in August 2013 when the European Commission approved the National Strategic Reference Framework (NSRF), a key strategic

document for the use of the EU Cohesion policy Funds, which ensures that the assistance from the Funds is consistent with both EU and national objectives and guidelines. The Operational Programme Regional Competitiveness (OPRC) represents a programme within the NSRF prepared for the use of the European Fund for Regional Development (ERDF) envisaged for the implementation of EU Cohesion policy allocated to Croatia for the financial perspective 2007-2013 under the Convergence Objective.

The key orientation of the OPRC is to achieve a "Higher Competitiveness of SMEs and Support to a Knowledge-based Economy" which is also an NSRF thematic priority. It consists of three priority axis: /1/Development and Upgrading of the Regional Infrastructure and Enhancement of the Attractiveness of Regions, /2/ Enhancing the Competitiveness of the Croatian economy and /3/ Technical Assistance. The strategy is to increase Croatia's competitiveness through the creation of a favourable business climate, involving support for SME, research and development, business and tourism-related infrastructure, networking and clustering, while respecting the principle of balanced regional development. It starts with an analysis of the current situation regarding Croatia's competitiveness, with special emphasis on the sector of the small and medium-sized enterprises (SME), resources for the area of research and development (R&D), tourism and issues characterising regional development. The document also includes a SWOT analysis and strategy for the relevant programming period.

The OPRC was designed by the Ministry of Regional Development and EU Funds (MRDEUF) and received an amount of €108.4m from ERDF. This is only a part of a total budget from the Structural and Cohesion funds for the first six months of the Croatian membership in the Union. The remaining resources include €120m for Transport, 149.8m for Environmental protection, €60m for Human resources and €11.2m for cross-border cooperation.

In the absence of strong industries that have been deteriorated during the transition to market economy, the regional economic structure is rather diverse and follows the natural assets of particular region. According to the Regional Innovation Scoreboard (EC, 2012a) the entire Croatia is moderate innovator while the most developed region is the Continental Croatia[10] which is classified as an innovation follower mainly due to the city of Zagreb which is financial, commercial, production and educational centre The prevailing business sectors in the Continental Croatia are financial intermediation and real estate, followed by the manufacturing industry, trade, construction, agriculture and forestry (RCOP, 2013). The eastern part of Continental Croatia is the economically most homogenous territory and shows a narrow and weak economic base oriented towards a single dominant activity, agriculture and forestry. Adriatic Croatia shows considerable heterogeneity, and is mostly specialized in tourism, followed by construction (RCOP, 2013). Regarding knowledge capacity and economic structure Croatia is classified by the European Competitiveness Report (EC, 2011) as low knowledge capacity country with a specialisation in low knowledge intensive sector (similar to Bulgaria, Romania, Poland and Turkey).

According to the recent available data 2009-2011(Eurostat) Croatia lags behind the most successful Member States and the EU average in high-tech exports, employment in knowledge-intensive activities as well as employment in high-technology manufacturing sector and high-tech knowledge-intensive services sectors. Nearly half of its exports are products that are resource-intensive (35, 7%, e.g. wood and textile industry) or low technology intensive (13.8% of our food industry-beverages, tobacco and sugar), while medium-tech products have 21. 1% a share in exports (e.g. chemical products, agricultural and industrial machinery) whiles the high-tech

[10] Since August 2012 Croatia is divided into only two NUTS regions- the Continental and the Adriatic Croatia.

products make up 15.3% of Croatian exports such as electrical machinery and appliances (Ćudina at al., 2012).

Business investment in R&D does not have only a steady downward trend (with the exception of pharmacy), but also keeps the existing structure of economy (Bečić and Dabić, 2012). It indicates that Croatia needs more efficient mechanisms to imply the new or key technologies, in order to change the obsolete economic structure and to overcome the technological gap. Within the industrial sector, the largest share of investments in R&D is made by the pharmaceutical companies that belong to the typical knowledge-based sector (division 21) and companies in the medium-high-technology manufacturing (divisions 27-29: electrical and machinery equipment, motor vehicles). However, companies in the low–technology manufacturing (divisions 10-11: food and beverages) are also significant investors in R&D.

The analysis of patent applications to EPO suggests that Croatia was much more diversified in terms of technological classes in the past, during the period 1995-2006, than in the recent period of technological development. In the period 1995-2006, it was possible to identify 15 specialisation in medium as well as high technologies such as Electrical engineering, Macromolecular chemistry, polymers, Food chemistry, Basic materials chemistry, Materials, metallurgy, Organic fine chemistry, Pharmaceuticals, Biotechnology, etc., in the period 2007-2011 only three technological specializations remained - pharmaceuticals, organic fine chemistry and civil engineering.
Talking about specialization in scientific research, it should be noted that the bio-medical and bio-technical research, such as biochemical engineering, molecular biology, medicine, pharmacy and related fields have the highest potential to bridge the existing gap in technology transfer and the commercialisation of science. Croatia has a solid platform for cutting-edge research in these fields and a critical mass of researchers located all over the country in institutions such as the Medical School of Zagreb, Medical School of Rijeka, the Institute of Immunology, The Croatian Institute for brain research, Mediterranean Institute for Life Science (MedILS) and a series of research units in polyclinics and hospitals (25 research units). The Medical School of Rijeka and the Croatian Institute for brain research have already proven its expertise by gaining millions of Euros from the EU FP for funding their research. Besides, the construction works on the incubation centre for the companies based on the biomedical and biotechnological research (BIOCentre) has started in November 2012. This is a green-field investment of over €18m of which 85% will be financed from the IPA programme.

The next most promising field for research and technological specialisation is in the domain of cognitive and robotic systems, cooperative network embedded systems and similar strategic areas developed by the Faculty of Electrical Engineering and Computing of the University of Zagreb. In addition to bio-medicine and robotics, traditional bio-technological research in the food and agriculture industry, forestry, energy (bio-fuels) and the environment (waste and water treatment) is of special interest for Croatia since it has a long tradition and significant research resources in these fields.

Talking about the further implementation of S3 strategy (post 2013) for efficient use of the Structural Funds with a focus on innovation and smart specialisation is envisaged by both the Economic programme of Croatia 2013 (MOE, 2013) and the new Strategy for Education, Science and Technology drafted in September 2013.

Both the documents relied upon the Strategy of cluster development 2011–2020, adopted in April 2011 which is based on the clusters' mapping using the three star methodology of the European Cluster Observatory and resulted in identification of 12 priority clusters (see Chapter

2.7). The Economic programme of Croatia for 2013 (MOE,2013) identified these clusters with the twelve priority sectors of Croatian manufacturing industry and plan to support their development in future by the 8 technology platforms and 4 key enabling technologies (see Chapter 2.7) . The three most important clusters - food, wood and car industry are already established in January 2013. As specified by the Economic Programme, the future development of identified clusters/industrial braches, platforms and KETs will be performed by the establishment of the /1/ High technology network for industry including the centres of competences and /2/ Competitive clusters (MOE, 2013:74).

The aim of the High technology networks is to create more dynamic interaction between the science and research and the business sector and enabling successful commercialisation of scientific research and the application of new technologies in industry. Activities designed within the framework of the. The competitive development of sectors as well as the development of new goods and services will be enabled by Key Enabling Technologies, even more in traditional sectors where the transition to innovative manufacturing processes becomes crucial for added value production. Government support should focus not only on low and medium innovations which is now the case but also on areas with high social and economic benefits that push out the technological frontiers. The challenge is, therefore, to re-vitalise research and innovation activities in both industrial (manufacturing) and service sector with a view of upgrading technological capabilities of companies towards higher technological capacities. The SME sector must find the means to increase the level of investment in research and innovation especially if it wants to keep its competitiveness after joining EU single market. An important task is to create conditions for the further development of today's small businesses and their growth into large and medium-sized enterprises that are able to develop a research function and research-based innovation

Resources from the Structural and Cohesion Funds for the next financial period 2014 - 2020 amounted to about € 8 billion. The MRRFEU started in April 2012 with the preparation of programmes, documents and actions. The MRRFEU organises the Partnership consultations which represent the start of public hearings on the areas that will be financed by the Structural Funds in the EU for the period 2014-2020. All the interested groups will be informally involved in such a way in the process of programming and development measures under the future Operational Programmes. Interested public had the opportunity to express an opinion on the development priorities of the Croatian on-line survey. The further public consultations are in progress.

The concept of smart specialisation is included in the new Strategy for Education, Science and Technology which draft is publicly presented on 16 September 2013. The Strategy highlights the three measures to include S3 in HEI and PRO: /1/ S3 conceptualisation in general /2/ definition of industrial value chain for each priority area of smart specialization, /3/ definition of guidelines for technological development aligned with the priority areas smart specialization.

4.5 International Scientific Cooperation

International research cooperation in Croatia is based on bilateral and multilateral international agreements and implementation of cooperative programmes. The international collaboration of educational, academic and scientific institutions involves the exchange of different forms of scholarship in all categories, the implementation of common scientific research projects and organizing international conferences and seminars.

Research cooperation involves primarily the bilateral programmes in line with the common interests and the priority areas of the countries involved. The Ministry supports bilateral research project on the two-year basis with the following countries: Albania, Austria, France, India, China, Hungary, Macedonia, Germany, USA and Slovenia. The main partners in bilateral cooperation for Croatia are Slovenia and Austria.

Around 200 bilateral research projects in all areas of science are currently in implementation. The most common are projects from natural, biomedical engineering and biotechnology. Ministry covers only the costs of travel by Croatian scientists abroad and living expenses of foreign partners in Croatia (mobility) to the implementing rules of the established programs.
The international mobility of researchers is of growing importance for Croatia in the context of more intensive participation of researchers within the FP and implementation of the Bologna process.

Although the research community suffers severe financial restrictions which limit funds for research quite seriously, foreign researchers could find many benefits to perform their research in Croatia such as excellent information and communication infrastructures, friendly environment ,easy communication in English and adequate research premises and campuses.
There are several research topics and groups which are internationally recognised and highly competitive and therefore might be very appealing for eminent foreign researchers to come to Croatia. These areas include bio-medical and bio-technical research, such as biochemical engineering, molecular biology, medicine, pharmacy and related fields.

The most important transatlantic cooperation is bilateral co-operation with the United States. It includes cooperation in scientific research and education. It has been performed for several decades (inherited from ex- Yugoslavia) and is currently based on two documents: /1/ Agreement between the Croatian Government and the Government of the United States on Scientific and Technological Cooperation, signed in Zagreb on 27 September, 2004 and /2/ Letter of Intent on the Fulbright program between the two governments signed in Zagreb on 27 October 1992.

Cooperation on bilateral scientific projects is established in a way that American researcher submits project proposal to the authorized agency in the U.S. (e.g. National Science Foundation, National Institutes of Health) and includes Croatian scientists as collaborators on the project. After the positive evaluation in the U.S. and allocated funds from the U.S. side, Croatian scientists are entitled to require co-financing from the Ministry of Science in Croatia.
Bilateral scholarships for education include the Fulbright programme, the Junior Faculty Development Program and the Lukšić Fellowships programme.

5 NATIONAL PROGRESS TOWARDS REALISATION OF ERA

5.1 More effective national research systems

The investments in R&D are rather low and stagnant in both public and private sector in the last three years. With the total investments in science and research (GERD) of around 0.75% of the GDP Croatia is considerably lagging behind the EU Member States. Per capita investment in R&D achieved only 16% of EU-28 average (€527.65 p/c versus €85.8 p/c). The Economic Programme of Croatia, adopted by the Government in April 2013, envisaged increasing in the share of GERD to 1.4% of the GDP by 2020. The amount will increase by a combination of national investments with investments through international programmes, including EU funds.

The availability of budgetary resources for many research and innovation programmes remains uncertain in the context of currently severe fiscal constraints. The share of the budget for the Ministry of Science, Education and Sports in the State budget for period 2013-2015 is planned to decrease from 9.69% in 2012 to 8.75% in 2015 (Official Gazette, 139/2012).

In 2013 the Government introduced a new funding model of scientific research directed towards greater financial accountability and responsibility of research institutions. By the new model the allocation of the competition based research grants was transferred from MSES to CSF in order to increase quality and competitiveness of research projects and groups. MSES will allocate the block-grants for HEI and PRO based on the Multi-annual institutional funding for research programmes the amount of which depends on the institutional performance indicators. The reform come into effect on 1 July 2013 based on the new Act and on the Decision on multi-annual institutional financing of research activities in public research institutes and universities 2013-2015, adopted on 6 June, 2013. The MSES will also finance the Scientific Centres of Excellence which will be established in Croatia for the first time during 2014.

Due to changes in the system of research funding which came into force in mid-2013 and a lack of data, it is difficult to calculate the ratio between institutional and competition-based project funding. It is especially difficult at universities which co-finance their activities through scholarships. However, the research activities in Croatia are mainly financed by the State budget allocated by the MSES that usually make 80% to 85% of total research funding at public research institutes and universities, as well. Generally speaking 70% of the allocated budget resources are spent on salaries, 10% on direct institutional funding (overheads, phone, energy, etc.), 10% on research grants (material and operational costs) and remaining 10% is spend on other research-supporting activities (conferences, publishing, etc.).

In the area of institutional assessment Croatia is at the forefront in the application of the European standards and guidelines since they were introduced in Croatia in 2009 by the adoption of the Law on Quality Assurance in Science and Higher Education (Official Gazette No. 45/2009). Based on the Law, the Agency for Science and Higher Education (ASHE) is carrying out the evaluation procedures (initial accreditation, re-accreditation and thematic evaluations). The evaluation reports are publicly available in the Archive of evaluation reports.

5.2 Optimal transnational co-operation and competition

Croatia participates in the transnational research programmes that include coordination of research priorities, plans and goals, but does not include cross-border flow of funds. It means that each country finances its own research teams and forms a sort of networking of funding. Such transitional programmers are EUREKA - industry-driven research and innovation projects and COST - one of the longest-running European programme for transnational cooperation in science and technology. The transnational programmes include participation in the transnational large infrastructural projects like CERN, EMBO, EMBL, ALICE, etc.

When comes to the ERA-NET type of projects Croatia participates in several ERA-NET initiatives such as ERACOBUILD, SmartGrids ERA-NET, HERA ERA-NET, ERA-NET ASPERA-2 and the SEE-ERA.NET PLUS. The most prominent in terms of grand challenges is the SEE-ERA.NET PLUS launched a Joint call for European Research projects in September 2009 in order to integrate isolated bilateral RTD initiatives into multilateral, jointly agreed activities with high synergetic impact in the field of grand challenges like energy, water purification, environment protection, biodiversity, etc. The final aim is to enhance the integration of the Western Balkan Countries into the European Research Area. The call budget is 3.5 million Euros.
There are no specific actions in order to align national research system with other European countries but the strategic documents take into account the research agendas and priorities of the EU.

Croatia participates in the four initiatives aimed at regional cooperation which should contribute to the cross-border interoperability of national programme, permit joint financing of innovation, and R&D and tackle grand challenges such as supply of energy, water and food, ageing societies, public health, environmental protection, etc. They include: the South East Europe (SEE) 2020 strategy adopted on 21 November 2013, the Western Balkans Regional R&D Strategy for Innovation (WBRIS) for the period 2014- 2020 which has been adopted on 25 October, 2013, the EU Strategy for the Danube Region (EUSDR) which is a macro-regional strategy adopted by the European Commission in December 2010 and endorsed by the European Council in 2011 and the EU Strategy for the Adriatic and Ionian Region which is in progress. Within the EUSDR the Danube-INCO.NET project will start in January 2014 which will support the coordination of funding mechanisms and funding partners in the region to develop the Danube Region Research and Innovation Fund (DRRIF) and scaling up joint funding mechanism towards a joint funding programme.

Croatia is a member of ESFRI (European Strategy Forum on Research Infrastructures) since October 2010 and participates in the four related projects: CLARIN , DARIAH, ESS and since January 2012 in SERSCIDA.CLARIN is devoted to establish an integrated and interoperable research infrastructure for the language technology needed in SSH research, DARIAH supports digitally-enabled research across the humanities and arts and ESS analyses attitudes, beliefs and behaviour patterns of diverse European populations. SERSCIDA is focused on social science data archiving and open access.

Croatia has not applied a strategic approach and policy objectives and strategies in accessing intergovernmental European infrastructures. Access to the national research infrastructure within the scientific institutions is organized by the Agency for Mobility and European Programmes. Regarding inclusion into Inter-governmental research organisations, as a result of multilateral agreements Croatia is a member of the European Molecular Biology Organization

(EMBO), Conference and European Centre for Medium-Range Weather Forecasts as well as engaged in program of the European Organisation for Nuclear Research.

5.3 An open labour market for researchers

In the area of an open labour market for researchers Croatia has made a big progress in the last two years by adoption of the Action Plan for Mobility of Researchers 2011-2012, Action Plan for Overcoming Obstacles and Enhancing International Mobility in Education for the Period 2010-2012 and the Action plan to Increase Absorption Capacity for Participation in the Framework Programmes (FP7) of the European Union 2013-2015. The main aim of the first Action plans is to remove obstacles for the international and inter-sectorial mobility, while the second one recommends granting work permit for teachers within LLL programme of the EU. The third Action Plan goes a step further and recommends granting the scientific jobs for exceptional scientists from abroad regardless their nationality and citizenship. In addition, the "Scientific visa" is in implementation in Croatia since 2009. It simplified entry of foreign researchers and have greatly facilitated researchers' mobility and international cooperation in Croatian science.
In 2008 the Ordinance on Determining the Requirements for Granting Temporary Residence to Foreigners for the Purpose of Scientific Research (Official Gazette 42/08) was adopted which significantly simplified the participation of foreign scientists in research activities in Croatia and receiving the work posts. In 2012 a new and improved Ordinance has been introduced with minor changes in 2013 (Official Gazette 92/12; Official Gazette 22/13). The Ordinance is available in English language as well."

"The Law on Science and Higher Education from 2003 adopted by the Government on 1 February 2013 (article 19) recommend that the procedures on recruitment have to be made public, preferably on the respective organisations' websites, in both the Croatian and English languages. The transparency of employment of foreign researchers has been improved through advertising job positions at the EURAXESS portal of the European Commission. According to the researchers report for Croatia in 2012 carried out by the Deloitte, the number of researchers posts advertised through the EURAXESS Jobs portal per thousand researchers in the public sector was 37 in Croatia compared with 8 among the Innovation Union reference group and an EU average of 24. As of June 2011, 328 publicly funded research jobs had been published on the EURAXESS portal and 88 research organisations from Croatia had registered for this activity. However, in 2013 more than 600 job vacancies have been published in the EURAXESS Jobs portal by Croatian research organisations and 167 research organisations from Croatia are registered at the portal
The incoming mobility of the researchers and university teaching staff is not however, very strong due to traditional closeness of the Croatian universities and scientific community. The main barrier is probably insufficient alignment of national research with global trends, lack of inclusion into the frontier research and still low international connectivity and networking. Many research groups in Croatia are not international highly competitive and therefore of little relevance for foreign researchers' scientific promotion and reputation. However, they can find many benefits to perform their research in Croatia such as excellent information and communication infrastructures, friendly environment, easy communication in English and adequate research premises and campuses.

In Croatia, publicly funded grants or fellowships are not portable to other EU countries. However, all programmes of the Croatian Science Foundation are open to researchers from all

around the world and no nationality restrictions are included. However, they cannot apply for grants, they can only to participate in the project implementation. Programmes of CSF and UKF which were open for application by foreigners are temporarily closed.

5.4 Gender equality and gender mainstreaming in research

Croatia has made a considerable progress in the area of women's rights and gender equality in recent years. The main policies that promote the equal treatment for men and women in society and science are formulated in the framework documents – the Act on Scientific Activity and Higher Education (OG 123/03), the Labour Act (OG 149/09, 61/11), the Gender Equality Act (OG 82/08), the Act on Prohibition of Discrimination (Official Gazette 85/08), and the Act on Maternity and Parental Benefits (85/2008). The main strategic document is the National Policy for Gender Equality 2011-2015 (OG 88/11) adopted with the aim of eliminating discrimination against women and establishing real gender equality. The main institutional mechanism for gender equality in Croatia is the Office for Gender Equality and the Parliamentary Committee for Gender Equality.

Female and male students are equally represented at all the levels of education. However, women do prevail in the total number of students who enrol in universities (with 57.3%), as well as in the total number of students who graduate (with 60.8%). It is important to add here that 51.1% of doctorates of science degrees (PhD) are held by women. It is almost two and a half times more than 50 years ago in 1964. The share of a man with a doctor's degree in the same period has been halved.

With 49.1% women employed in the research and development sector in 2010 (expressed in FTE), Croatia has reached gender parity in research activities. The fastest growth of female participation in the research activities has occurred in the business sector where they now account for 41.9 % (headcount) but they prevail in the government sector where women represent 54%.
Turning to higher education, with 46.4% of the total number of academic staff being women, Croatia has nearly reached equal representation. However, female representation at the full professor rank is lower (27.4%) and increases from the rank lecturers (associate professors (40.5%); assistant professors (46.1%)) and assistants where women make up 54.5%. However, in higher education institutions only 14% of women hold rector, and 17% dean positions. Despite this, the number of women holding leading positions in public research institutes is notably better, where 40% of directors are women.
The representation of women in decision-making bodies in Croatia revolves, as recorded by the Women and Men in Croatia for 2012, around 20% on average. The average of 20% applies for posts for local (city/county) assembly representatives as well for ministers (20%) and ambassadors (18.5%) and a share of women in the Croatian Parliament.
There are no legally binding quotas, but the Gender Equality Act (Article 12.3) stipulates that the special measures should be introduced to promote equal opportunities if one of the sexes is substantially underrepresented (less than 40%). There is also a legal obligation for introducing specific measures for preventing imbalance on election lists, according to the 40% objective but usually it is not met in practice.
The Action plan Science and Society which was released in December 2012 by the Ministry of Science, Education and Sports proposes two measures for gender equality in research sector: /1/ Equalization of sex/gender ratio of researchers in the system, especially in management structures (minimum 1/3 of women in national councils, regional councils, main committees,

scientific and political bodies, etc.), and /2/ Introducing the programmes of stimulation of female scientists with the goal of increasing gender equality.

5.5 Optimal circulation, access to and transfer of scientific knowledge including via digital ERA

Open access (OP) to the scientific information is of great importance for the Croatian scientific community which has very limited resources for purchasing commercial scientific information and databases. This confirms the Croatian declaration of open access which was initiated in October 2012 and has been signed by more than 500 researchers in a couple of months. The open access is enabled by the University Computing Centre (SRCE) which provides communication and information infrastructure (e-infrastructure).

Croatian Government encourages open accessibility to the results of publicly funded research. The Ministry of Science, Education and Sports supported the Croatian scientific portal, a project that marked the beginning of OP in Croatia in 2006. The Portal combines, in one place, all information about Croatian scientists, their papers and research projects, Croatian journals and scientific instruments. The aim is to provide better interconnection between scientists as well as promotion and popularisation of science in Croatia and abroad. The Portal provides several informational services which afford open access to all scientific information resulted from public funding research, as follows: the Croatian scientific bibliography - CROSBI, the Croatian scientific journals portal – HAMSTER and the Who's who in Croatian science. For example, HAMSTER provided by October 2010 access to 222 journals, 4121 issues and 54163 full text articles.
Croatian government established in 1995 the Croatian Academic and Research Network (CARNet), a network of Croatian academic, scientific and research community, as well as of institutions of elementary and high school educational system. It provides more than 60 different services to academic community such as e-library, electronic identity, e-mail, e-learning, etc.

The MSES supported the establishment of the Croatian National Grid Infrastructure - CRO NGI, which operates in accordance with the European network. Part of CRO NGI infrastructure is connected to the Worldwide grid infrastructure European Grid Infrastructure (EGI).

The authentication and authorization infrastructure of the Croatian research and education community is developed within the AAI@EduHr project in 2006. AAI@EduHr today covers complete Croatian research and education community with 22 identity providers with over 680.000 electronic identities and over 230 services that utilise those identities. AAI@EduHr is opened for international cooperation and cross-federation connections.

Annex 1. Performance the national and regional research and innovation system

Feature	Assessment	Latest developments
1. Importance of the research and innovation policy	(-) Research and innovation are not considered as key drivers of the competitiveness and job creation (-) Low levels of coherence between public actions in relevant policy areas and low orientation towards fostering research and innovation (-) Thematic priorities and sectoral policies are not a general practice in Croatia – most policies are designed to support and equally develop all	(+) Increasing awareness on importance of research and innovation
2. Design and implementation of research and innovation policies	(-) Lack of financial resources for R&D and innovation support measures and programmes (-) Lack of R&D priorities (-) Coherent monitoring and evaluation are still not a general practice, although are developing over the last few years (+) Orientation of institutional funding of HEIs and PROs on scientific excellence and multi-annual contracts	(+) National Strategy for the Croatian innovation development 2013-2020 is in progress (+) National industrial strategy is currently being prepared (+) Development of Smart Specialisation Strategy is in progress (+) Institutional funding of HEIs and PROs has changed and now is based on multi-annual contracts between MSES and institutions, budgets are allocated based on scientific excellence (+) Second Science and Technology Project (STP II) was launched in April 2013, and should ensure additional financial resources for R&D and innovation support measures
3. Innovation policy	(-) Promotion of innovation is not planned and directed toward target groups, and comes down to rare successful projects	(+)National Strategy for the Croatian innovation development 2013-2020 is expected to bring new support measures based on the best practices of countries successful in innovation development
4. Intensity and predictability of the public investment in research and innovation	(-)Innovative financing solutions (e.g. PPP) and tax incentives are not utilised for innovation development (-) Supply and demand-side policies do not seem to develop in a consistent manner	(+)National Strategy for the Croatian innovation development 2013-2020 is expected to bring new support measures based on the best practices of countries successful in innovation development
5. Excellence as a key criterion for research and education policy	(-) Public investment in education, research and innovation was not considered as a national priority until recently (+) Shift towards more efficient and transparent national R&D funding, with an emphasis on a competitive basis (-) Insufficient capacities of relevant institutions in preparation and implementation of projects for EU funding (-) Insufficient mobility of researchers and students (+) Increasing awareness on importance of evaluation and monitoring systems (-) Croatia is still not considered as an attractive destination for development of research careers	(+) Act on Amendments and Supplements to the Act on the Croatian Science Foundation (CSF), adopted in July 2012 (+) Act on Science and Higher Education adopted in July 2013 (+) Act and the Decision on multi-annual institutional financing of research activities in public research institutes and universities 2013-2015, adopted in June 2013 (+) Second Science and Technology Project (STP II) launched in April 2013 (+) Capacity building of relevant institutions for attracting resources from Structural Funds has been recognised as a priority (+) New measures aimed at mobility of researchers have been introduced in 2013

6. Education and training systems	(-) Education programmes are not adjusted to labour market needs (-) Education and training curricula still lacks orientation towards development of skills required on a labour market, and a high share of available programmes is focused on theory, rather than mix of theory and practice (-) Education is not oriented towards addressing innovation skill gaps (-) Learning outcomes are not strictly defined and significantly vary between institutions that should be comparable.	(+) The existence of considerable gaps between education system and labour market has been recognised as one of the structural problems of Croatian economy (+)National Strategy for the Croatian innovation development 2013-2020 is expected to introduce new measures aimed at addressing innovation skill gaps
7. Partnerships between higher education institutes, research centres and businesses, at regional, national and international level	(-) Low levels of cooperation between science and industry (-) IPR on Croatian Universities needs to be further regulated in order to facilitate creation of spinouts and start-ups (-) Low mobility of researchers between public and private sectors (+) Increasing participation in transnational partnerships and collaboration	(+) BICRO is implementing several programmes aimed at commercialisation and cooperation between science and industry (+)National Strategy for the Croatian innovation development 2013-2020 is expected to introduce new measures aimed at developing partnerships between science and industry
8. Framework conditions promote business investment in R&D, entrepreneurship and innovation	(-) Business environment is not conductive to innovation (-) Administrative burdens and pointless regulation hinder innovation in the companies (-) Venture capital and equity finance are still highly underdeveloped	(+) State administration reform has been initiated but it has progressed very slowly. (+) Anti-corruption activities have improved the quality of business environment. (+) Government attempted to fill in the gaps in the availability of credit and equity financing (through programmes of the Croatian Bank for Reconstruction and Development and co-financing of equity Funds for Economic Cooperation). (+) EU accession and implementation of regional (NUTS 3) development strategies for the period 2011 - 2013 provide some stimuli to innovation policy development.
9. Public support to research and innovation in businesses is simple, easy to access, and high quality	(-) Public support measures, with a few exceptions, are not well targeted, and general conditions that need to be satisfied are usually not known before the public call is published, which seriously influences the quality and the number of applications (-) Evaluation of applications usually takes a long time and is, in a number of cases, based on vague criteria which are commonly a subject of subjective appraisal of the evaluator (-) Bureaucracy is complicated and time-consuming, often inconsistent with the deadlines (-) Rules and timetables are in most cases, especially when it comes to public calls aimed at allocation of EU funding, unknown before the publication of the individual call	(+) Public procurement procedures have been simplified since July 2013 (+) BICRO's Proof of Concept programme has proven to be successful and well-targeted towards innovative companies, promoting commercialisation and cooperation of industry and academia
10. The public sector itself is a driver of innovation	(-) Public sector is not an innovation driver (-) Public procurement is not used as a mechanism in innovation development (+) Almost all relevant research data produced in the country are publicly available through the Croatian scientific portal	(+)National Strategy for the Croatian innovation development 2013-2020 is expected to introduce measures oriented towards using public procurement as a mechanism in innovation development

Annex 2. National Progress on Innovation Union commitments

		Main changes	Brief assessment of progress / achievements
1	**Member State Strategies for Researchers' Training and Employment Conditions**	(+) The Act on Science and Higher Education adopted in 2013 (by article 19 - all research and academic positions are open to foreigners and must be published on EURAXESS portal); (+) Action Plan for Mobility of Researchers 2011-2012 (six measures aimed at removing the obstacles for inward and outward mobility of researchers); (+)Action plan for overcoming obstacles and enhancing international mobility in education for the period 2010-2012 (foreigners may carry out practical training without a work permit within LLL); (+)Action plan to Increase Absorption Capacity for Participation in the Framework Programmes (FP7) of the European Union 2013-2015 (the measure no. 9 recommends to grant scientific jobs for scientists from abroad (regardless of nationality and citizenship); (+) Ordinance on the Registry of Researchers (Official Gazette 82/2010) (Croatian citizenship as a requirement for entry into the Registry of researchers was removed); (+) Ordinance on Determining the Requirements for Granting Temporary Residence to Foreigners for the Purpose of Scientific Research (OG 92/12, 22/2013) (Introduction of the tax breaks for foreign researchers with temporary residence); (+) The use of "Scientific visa" is increasing; (+) EURAXESS programme is receiving more importance (-) The State budget for research is decreased;	The implementation of the "Charter & Code" principles is publicly promoted and supported by the Ministry of Science, Education and Sports through the Strategy of Education, Science and Technology, Action Plan for Mobility of Researchers 2011-2012, Action Plan to Encourage Investment into Science and Research and EURAXESS portal; (+) The number of researchers posts advertised through the EURAXESS Jobs portal per thousand researchers in the public sector was 37 in Croatia compared with 8 among the Innovation Union reference group and an EU average of 24. As of June 2011, 328 publicly funded research jobs had been published on the EURAXESS portal and 88 research organisations from Croatia had registered for this activity; moreover in 2013 more than 600 job vacancies have been published in the EURAXESS Jobs portal by Croatian research organisations and 167 research organisations from Croatia are registered at the portal; (+) Main principles of the Charter end Code are already incorporated in the national legislation and internal regulations of individual institutions; (+) By March 2013, 37 research and higher education institutions have signed the Declaration of Commitment to the Principles of the Charter and the Code; (+) 14 institutions received acknowledgement and logo by the European Commission for the "HR Excellence in Research"; (+) the University of Rijeka made the Internal analysis on Charter and Code implementation; (+) Since the beginning of Scientific visa the procedure was used by 11 scientific organisations and a total of 78 requests for hosting scientists from 23 countries have been approved; (+)From its establishment in 2008, the EURAXESS Service Centre processed more than 2000 queries from foreign researchers and Croatian research organisations; (-) Many barriers still remain to the implementation of open and transparent recruitment of foreign researchers;
4	**ERA Framework**		
5	**Priority European Research Infrastructures**	(-) The national roadmap for ESFRI is not carried out; (-) the membership fee for ESFRI is not planned in the budget; (+) The Draft of the Strategy of Education, Science and Technology stress the need for inclusion in ESFRI through establishing the national strategic forums;	**(+)** Croatia is a member of ESFRI (European Strategy Forum on Research Infrastructures) since October 2010 and participates in the four related projects: CLARIN, DARIAH, ESS and since January 2012 in SERSCIDA; (-) there is a lack of resources for the national research infrastructures and inclusion into the international initiatives; (+) FP projects brought significant funds for the national RI and the same is expected from the SF;
7	**SME Involvement**	(+) The programme of incentives to entrepreneurship and crafts "Entrepreneurship impulse 2013", doubled the grants compared to last year (+) Regional Competitiveness Operational Programme is adopted and includes grants new technologies and production processes;	(-) Further efforts are needed to facilitate SME involvement in research (-) Despite policy measures and investments SMES are not drivers of high-potential innovation or actors in industrial leadership and they invest very small resources in R&D

		Main changes	Brief assessment of progress / achievements
11	**Venture Capital Funds**	(-) No specific measures have been introduced	(-) Venture capital funding remains rather underdeveloped in Croatia
13	**Review of the State Aid Framework**	(+) New State Aid Act was adopted in June 2013 that corresponds with EU regulation (-) No specific measures regarding State Aid for R&D and innovation have been introduced	(-) There is a lack of knowledge on State Aid issues in Croatia when it comes to development of infrastructure projects, even when it comes to research and innovation infrastructure
14	**EU Patent**	(+) Croatia joint the EU on 1 July 2013, what is a pre-condition for ratification of a Unified Patent Court	(+) Croatia is in the process of preparation for joining the enhanced cooperation on the unitary patent protection that is a first step in the "patent package" that include signing the Agreement on a Unified Patent Court and finally its Ratification
15	**Screening of Regulatory Framework**	**(**+) Evaluation procedures are slowly being introduced in R&D and innovation programmes (+) Evaluations of several R&D and innovation supporting measures has been conducted over the last two years and summary results have been made publicly available	(+) Increasing awareness of public institutions on importance and benefits of regular evaluation procedures (+) Assessment of the National Innovation System in Croatia: Background Report (OECD, 2012) provided a valuable insight on benefits and gaps of the overall research and innovation system in Croatia
17	**Public Procurement**	(-) No specific measures have been introduced	(+) Although no new measures have been introduced fostering innovation have been introduced, the draft National Innovation Strategy has recognised public procurement as an important mechanism in innovation development – specific measures are currently being developed (-) No specific measures or actions have been introduced so far
20	**Open Access**	(+) open access to information on research carried out in Croatia has a long tradition through the Croatian scientific portal (research project and institutions), Croatian scientific bibliography - CROSBI, the Croatian scientific journals portal – HAMSTER and the Who's who in Croatian science; (+) the Croatian declaration of open access which was initiated in October 2012 was signed by more than 500 researchers in a couple of months; (-) budget resources are not sufficient for fees to access foreign full text DB;	(+) the open access to almost all relevant research data produced in the country are publicly available through the Croatian scientific portal (full text journals, bibliography of researchers, projects financed by MSES); (+) the information are daily updated (CROSBI and HAMSTER) and provide valuable information, e.g. HAMSTER provided access to 222 journals, 4121 issues and more than 54200 full text articles; (+) Since 2013 Croatia is a member of ESFRI programme - SERSCIDA focused on social science data archiving and open access; (-) OA to full text databases of foreign journals is critically low to enable normal research work;
21	**Knowledge Transfer**	(-) No policies or instruments aiming at protection of the results of publicly funded research have been introduced (-) National knowledge transfer strategy does not exist	(-) IPR on Croatian Universities needs to be further regulated in order to facilitate creation of spinouts and start-ups (-) Cooperation between science and industry remains low in Croatia
23	**Safeguarding Intellectual Property Rights**	(+) Law on Competition was fully aligned with the EU regulation in June 2013, including the Article 101 of the Treaty on the Functioning of the European Union	(+) Law on Competition was fully aligned with the EU acquis in June 2013
24	**Structural Funds and Smart Specialisation**	(+) The Strategy of cluster development 2011–2020, (April 2011) identified 12 clusters with competitive advantages in Croatia; (+)The National Strategic Reference Framework (NSRF) a key strategic document for the use of the EU Cohesion and Structural Funds was approved in August 2013 by the EC	(+) The ground for S3 is established by clusters' mapping using the three star methodology of the European Cluster Observatory is carried out and resulted in identification of 12 priority clusters; (+)The policy framework is established through the NSRF, OPRC and Economic programme for 2013

		Main changes	Brief assessment of progress / achievements
		The Operational Programme Regional Competitiveness (OPRC) (October 2012) defined the priority axes for allocation of ERDF in 2007-2013 (+) The Economic programme of Croatia for 2013 identified twelve industrial sectors aligned with identified clusters of competitiveness; it also identified eight technology platforms and 4 key enabling technologies (KET);	(+) The organisational framework for carrying out S3 is established which includes an Inter-ministerial working group for S3, sectoral groups and foreign consultants; (-) The identified 12 areas of clusters/industrial branches development are still rather broad; (-) there is a lack of serious analysis of factual research, business and human resources for the selection of industrial platforms and KETs; (-) the preparation of S3 is going rather slow, time is short and there is a risk that the Strategy will not be sufficiently analytical, innovative and based on real and useful data;
25	**Post 2013 Structural Fund Programmes**	(+) The Steering Committee for the development of programme documents for the financial period the EU 2014.-2020 is established (OG, 102/2012) (+) The seven Thematic working groups to draft proposals of the programming documents are established; (+) The Partnership consultations including public hearings are started; 8+) A public call for projects proposals for the EU Structural Funds 2014-2020 for research infrastructures is announced in October 2012 by MSES; (+) Economic programme for 2013 foresees the further development of S3 through /1/ high technology networks for industries including the Centres of competences and /2/ Competitive clusters which can be performed in the financial period 2014-2020; (+) A draft of new Strategy for Education, Science and Technology (September 2013) envisaged inclusion of HEI and PRO in smart specialisation;	(+) The preparation actions for allocation of SF 2014-2020 started in 2012 by MRRFEU; (+) The organisational framework for carrying out financial period 2014-2020 is established which includes an Inter-ministerial working group, 7 Thematic working groups and Partnership consultants; (+) Public hearings on the development priorities for the SF 2014-2020 are organised through the partnership consultations (interested public had the opportunity to express its opinion) (+) There are 15 project proposals for establishing research and technological infrastructures collected by the MSES for using the SF 2014-2020; (+) Research and higher education institutions recognised the importance of SF for their inclusion into S3;
26	**European Social Innovation pilot**	(-) No specific measures have been introduced	(-) No specific measures have been introduced (+) Measures supporting social innovation have been proposed in draft National Innovation Strategy. However, the Strategy has not been completed yet.
27	**Public Sector Innovation**	(-) Specific actions are not undertaken	(-) Specific actions are not undertaken; (+) Majority of government owned data are publicly available in standard formats on a request;
29	**European Innovation Partnerships**	(+) Croatia participates in 20 initiatives under EIP on Active and Healthy Aging (-) There is no data on Croatian participation in other EIPs	(-) Croatian participation in EIPs is rather limited (-) EIPs or benefits from participation in EIPs have not been promoted on a national level
30	**Integrated Policies to Attract the Best Researchers**	(+) New action plans and rules are in place to enhance international mobility o researchers (see Action 1); (-) Mobility programmes of UKF and CSF to attract high-quality foreign researchers like the Installation grant or Cross-border grant are currently terminated;	(-) Despite the action plans and regulations for fostering mobility, yet many "hidden" rules hinder employment of foreign researchers;
31	**Scientific Cooperation with Third Countries**	(+) Croatia has concluded bi-lateral S&T and education agreements with a number of individual Third countries, as follows: India, Israel, Japan, Canada, China, Russia, USA, Switzerland;	(+) About a total of 200 projects within all bilateral agreements are in implementation; (-) there is no special strategies in this area;

		Main changes	Brief assessment of progress / achievements
		(+) It also concluded bi-lateral S&T and education agreements with EU candidate countries - Montenegro, FYR Macedonia, Serbia, Turkey and potential candidate country - Bosnia and Herzegovina; (-) There is no recent policy developments in this area;	
32	**Global Research Infrastructures**	(+) Croatia participate in CERN, EMBO (European Molecular Biology Organization), IIR (International Institute for Refrigeration), ICGEB (International Centre for Genetic Engineering and Biotechnology); (+) The establishment of the Croatian National Grid Infrastructure - CRO NGI is supported which is partly connected to the Worldwide grid infrastructure European Grid Infrastructure (EGI); (-)There is a lack of resources for membership in global infrastructures initiatives; (-) The strategic approach and policy objectives and strategies in accessing European or global infrastructures are not devised;	(-) Participation is based on a d-hoc basis according to the needs and projects in progress; (+) Researchers usually mange to participate in the global projects of interests but with great difficulties due to the lack of resources;
33	**National Reform Programmes**	Not applicable	Not applicable

Annex 3. NATIONAL PROGRESS TOWARDS REALISATION OF ERA

ERA Priority	ERA Action	Recent changes	Assessment of progress in delivering ERA
1. More effective national research systems	Action 1: Introduce or enhance competitive funding through calls for proposals and institutional assessments	• Act on Amendments and Supplements to the Act on the Croatian Science Foundation (CSF), adopted in July 2012 • Act on Science and Higher Education adopted in July 2013 • Act and the Decision on multi-annual institutional financing of research activities in public research institutes and universities 2013-2015, adopted in June 2013 • Second Science and Technology Project (STP II) launched in April 2013	(+) Amendments to the Act on the CSF are aimed at strengthening the competition for research grants; strengthening research quality and scientific excellence; promoting CSF into the principle funder of competition based research projects and complementing the new model of performance-based institutional funding (-) Limited financial resources for research and innovation, which also delayed full implementation of the Act on Amendments and Supplements to the Act on the CSF (+) Act on Science and Higher Education introduced a multiyear performance based institutional funding, opposite from former "per head" institutional funding, which is also in line with the recommendations of the World Bank (-) Lack of publicly available data on actual financial allocations from the State budget (+) STP II project by the World Bank ensured €24m, for Capacity Building for absorption of the EU funds and Research and Innovation Programmes
	Action 2: Ensure that all public bodies responsible for allocating research funds apply the core principles of international peer review	There were no recent changes in this area.	(+) Evaluations are gradually becoming more important in delivering and monitoring support measures and programmes (+) International peer review processes for allocating research grants gained increasing importance with the establishment of independent research funding agencies in Croatia (+) Higher education and scientific institutions are a subject to initial accreditation, re-accreditation and thematic evaluation evaluations conducted by Agency for Science and Higher Education, based on Act on Quality Assurance in Science and Higher Education and Procedure of Thematic Evaluation
2. Optimal transnational co-operation and competition	Action 1: Step up efforts to implement joint research agendas addressing grand challenges, sharing information about activities in agreed priority areas, ensuring that adequate national funding is committed and strategically aligned at European level in these areas	• Croatia became the 28th EU member in July 2013 and gained access to Structural Funds	(-) Sectoral R&D policies or support to specific thematic areas are not common policy practice in Croatia (+) Availability of financial resources from Structural Funds
	Action 2: Ensure mutual recognition of evaluations that conform to international peer-review standards as a basis for national funding decisions	• Act on Amendments and Supplements to the Act on the Croatian Science Foundation (CSF), adopted in July 2012 • Act on Science and Higher Education adopted in July 2013 • Act and the Decision on multi-annual institutional financing of research activities in public research	(+) Changes in relevant legislation are aimed at strengthening the competition for research grants; strengthening research quality and scientific excellence; promoting CSF into the principle funder of competition based research projects and complementing the new model of performance-based institutional funding (-) Development of monitoring and evaluation mechanisms and procedures

ERA Priority	ERA Action	Recent changes	Assessment of progress in delivering ERA
		institutes and universities 2013-2015, adopted in June 2013	should be significantly more developed
	Action 3: Remove legal and other barriers to the cross-border interoperability of national programmes to permit joint financing of actions including cooperation with non-EU countries where relevant	• Participation in the four regional strategies and initiatives which aims to connect and integrate research and innovative capacities of included countries, as follows: South East Europe (SEE) 2020 Strategy, Western Balkans Regional R&D Strategy for Innovation (WBRIS), EU Strategy for the Danube Region (EUSDR), EU Strategy for the Adriatic and Ionian Region which is in progress.	(+) Participation in various intergovernmental organisations, such as EUREKA, COST, EMBL/EMBO CERN, ERIC, etc. (+) Intensive international research cooperation through bilateral, multilateral and transnational projects and programmes (+) Extensive experience in transnational cooperation acquired through participation in IPA programme, including cooperation with the EU member states and non-member states (-) IPA co-funded projects were not strongly oriented towards R&D
	Action 4: Confirm financial commitments for the construction and operation of ESFRI, global, national and regional RIs of pan-European interest, particularly when developing national roadmaps and the next SF programmes	• Preparation of project pipeline for infrastructure projects for the ERDF 2014 – 2020, since 2012 • Establishment of the Committee for Scientific Infrastructure • Preparation of the National Roadmap for Science Infrastructure •	(+) Possibility to develop research infrastructures through EU Structural Funds, primarily ERDF (+) Development of guidelines on existing and new national research infrastructures (+) Croatia is a member of ESFRI and participates in the four related projects – CLARIN, DARIAH, ESS and SERSCIDA (-) there is a lack of resources for the national research infrastructures and inclusion into the international initiatives; (-) The national roadmap for ESFRI is not carried out; (-) the membership fee for ESFRI is not planned in the budget; (+) The Draft of the Strategy of Education, Science and Technology stress the need for inclusion in ESFRI through establishing the national strategic forums;
	Action 5: Remove legal and other barriers to cross-border access to RIs	There were no recent changes in this area.	(+) Access to the national research infrastructure is organised by the Agency for Mobility and EU Programmes
ERA priority 3: An open labour market for researchers	Action 1: Remove legal and other barriers to the application of open, transparent and merit based recruitment of researchers	• Ordinance on Determining the Requirements for Granting Temporary Residence to Foreigners for the Purpose of Scientific Research was adopted in 2012 and amended in 2013 • Action Plan to Increase Absorption Capacities for Participation in the Framework programmes of the European Union 2013 – 2015 was adopted in 2013	(+) Significant simplification of the participation of foreign researchers in Croatia over the last several years (+) New regulations prescribe conditions for granting temporary residence to foreigners for a period longer than three months for the purpose of conducting scientific research and introduce tax reliefs for foreign researchers with temporary residence in Croatia (+) Action Plan recommends to approve scientific jobs to researchers from abroad who have demonstrated their skills in management of international competitive research projects and express the interest to work in Croatia (+) Action Plan also envisages an audit of requirements for election into scientific professions and jobs, with the emphasis on inclusion and participation in international competitive projects as a criteria for selection in scientific professions,

ERA Priority	ERA Action	Recent changes	Assessment of progress in delivering ERA
			particularly for higher academic ranks (such as Senior Research Fellow and Research Fellow) (-) Mobility of researchers and students is still insufficient, and requires additional efforts towards increasing mobility
	Action 2: Remove legal and other barriers which hamper cross-border access to and portability of national grants	• Unity through Knowledge Fund programme Cross-border grants were introduced in 2012 • Marie Curies COFUND – NEWFELPRO	(+) UKF cross-border grants are aimed towards attracting promising research projects to Croatian companies and institutions (+) NEWFELPRO is aimed at fostering the mobility of young outgoing and incoming scientists and the repatriation of Croatian scientists (+) Several funding programmes have been opened to foreign researchers (Postdoc, Installation grants, Crossing Borders Grant)
	Action 3: Support implementation of the Declaration of Commitment to provide coordinated personalised information and services to researchers through the pan-European EURAXESS3 network	There were no recent changes in this area.	(+) "Scientific visa" has been implemented in 2009 (+) Researchers' mobility network in Croatia – EUROAXES, provides useful information for foreign researchers in Croatia and offers assistance (accommodation, childcare, healthcare, etc.) and has significantly improved transparency of foreign researchers employment through advertising job positions (+) Agency for Mobility and EU Programmes publishes the Foreign Researcher's Guide to Croatia
	Action 4: Support the setting up and running of structured innovative doctoral training programmes applying the Principles for Innovative Doctoral Training.	There were no recent changes in this area.	(+) Croatian Science Foundation is administrating several programmes aimed at doctoral students – Fellowship for doctoral students and National Training Courses and Summer Schools for Doctoral Students, which have been implemented since 2004 and 2005
	Action 5: Create an enabling framework for the implementation of the HR Strategy for Researchers incorporating the Charter & Code	There were no recent changes in this area.	(+) 37 institutions included in Croatia's research and higher education system had signed the Declaration of Commitment to the Principles of the Charter and Code. (+) 14 institutions have conducted internal analysis on its implementation such as the Institute of Physics, the Institute of Public Finance, the Institute of Social Research. (+) Eleven public and one private research organisations have completed the self-evaluation studies of existing human resources practices with the aim to carry out the action plans for human resources strategy for researchers. (+) The University of Rijeka was the first research organisation to complete the implementation procedure and earned the EC HR logo.
ERA priority 4: Gender equality and gender mainstreaming in research	Action 1: Create a legal and policy environment and provide incentives	National scholarship programme for "For Women in Science" of the L'ORÉAL Adria and Croatian Commission for UNESCO was introduced in 2012	(+) Inclusion of a gender dimension in all policy areas has become compulsory since the introduction of the National Policy for gender Equality 2011 – 2015 (+) National scholarship programme for "For Women in Science" provides scholarships for women researches under the age of 35 and who are in the last phase

ERA Priority	ERA Action	Recent changes	Assessment of progress in delivering ERA
			of their doctoral dissertations in natural sciences
	Action 2: Engage in partnerships with funding agencies, research organisations and universities to foster cultural and institutional change on gender	There were no recent changes introduced in this area.	
	Action 3: Ensure that at least 40% of the under-represented sex participate in committees involved in recruitment/career progression and in establishing and evaluating	Action plan Science and Society was introduced in December 2012	(+) The Action Plan Science and Society aims encourage and achieve sex/gender equality in science, recommending that national and regional councils, main committees, as well as scientific and political bodies should consist of at least 1/3 of women members (+)Considerable progress in the area of women's rights and gender equality in recent years: • 51.1% of PhDs are women • 49.1% of all employed in R&D (FTE) are women • 46.4% of the total number of academic staff are women
ERA priority 5: Optimal circulation, access to and transfer of scientific knowledge including via digital ERA	Action 1: Define and coordinate their policies on access to and preservation of scientific information	Croatian Declaration of Open Access to Scientific Information was introduced in October, 2012	(+) Government encourages open accessibility to the results of publicly funded research (+) The Declaration stems to alert every stakeholder dealing with science in Croatia to open access – Scientific information created by Croatian citizens should have open access. The Declaration was signed by more than 500 researchers in just a few months (+) The Declaration has been only partially implemented (+) Most of the works published by Croatian researchers have been made publicly available through the Croatian Scientific Bibliography – CROSBI (-) Lack of financial resources for purchase of scientific journals and other publications
	Action 2: Ensure that public research contributes to Open Innovation and foster knowledge transfer between public and private sectors through national knowledge transfer strategies	Second Science and Technology Project (STP II) was launched in 2013	(+) STP II provides funding for upgrading research capacities including the programmes for technology transfer and open knowledge flow between the sectors
	Action 3: Harmonise access and usage policies for research and education-related public e-infrastructures and for associated digital research services enabling consortia of different types of public and private partners	There were no recent changes introduced in this area	(+) The Croatian Academic and Research Network – CARNet provides e-infrastructures for the Croatian Scientific Community (+) The Croatian National Grid Infrastructure (CRO NGI) was introduced in 2007, to provide public e-infrastructure for the Croatian scientific community
	Action 4: Adopt and implement national strategies for electronic identity for researchers giving them transnational access to digital research services	There were no recent changes in this area	(+) Regulations of the legal framework for developing an authentication and authorisation infrastructure for the Croatian research community was ensured in 2008 through the introduction of the Regulations on the organisation of Authentication and Authorisation Infrastructure of science and higher education in Croatia – AAI@EduHr

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LIST OF ABBREVIATIONS

ASHE	Agency for Science and Higher Education
BERD	Business Expenditures for Research and Development
BICRO	Business Innovation Agency of Croatia
CASA	Croatian Academy of Sciences and Arts
CERN	European Organisation for Nuclear Research
COST	European Cooperation in Science and Technology
CSF	Croatian Science Foundation
CSIPO	Croatian State Intellectual Property Office
EHEA	European Higher Education Area
ERA	European Research Area
ERA-NET	European Research Area Network
ERDF	European Regional Development Fund
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESF	European Social Fund
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EU-28	European Union including 28 Member States
FDI	Foreign Direct Investments
FP	European Framework Programme for Research and Technology Development
FP7	Seventh Framework Programme
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
HIT	Croatian Institute of Technology
IP	Intellectual Property
IPR	Intellectual property rights
IRCRO	Collaborative research development Programme
KONCRO	Competitiveness and technology process advancement Programme
MEC	Ministry of Entrepreneurship and Crafts
MELE	Ministry of Economy, Labour and Entrepreneurship
MLPS	Minister of Labour and Pension System
MRDEF	Ministry of Regional Development and European Funds
MoE	Ministry of Economy
MSES	Ministry of Science, Education and Sports

NCHE	National Council for Higher Education
NCS	National Council for Science
OECD	Organisation for Economic Co-operation and Development
PRO	Public Research Organisations
R&D	Research and development
RAZUM	Development of the knowledge-based companies Programme
RI	Research Infrastructures
RTDI	Research Technological Development and Innovation
RTO	Research and Technology Organisation
S&T	Science and technology
SCF	Strategic Coherence Framework 2007-2013
SDF	Strategic Development Framework 2006–2013
SF	Structural Funds
SIIF	Science and Innovation Investment Fund
SME	Small and Medium Sized Enterprise
SVEZNATE	Strategic Council for Science and Technology
TEST	Technology oriented projects Programme
UKF	Unity through Knowledge Fund
VC	Venture Capital
VNIS	National Innovation System Council of Ministry of Science, Education and Sports

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